AT&T Services, Inc.
1120 20th Street, NW
Suite 1000
Washington, DC 20036

T: 202.457.2055
mg7268@att.com
att.com

October 22, 2019

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
Washington, D.C., 20554

Re: Expanding Flexible Use of the 3.7 to 4.2 GHz Band, GN Docket No. 18-122

Dear Ms. Dortch:

AT&T Services, Inc., on behalf of the subsidiaries and affiliates of AT&T Inc. (collectively, "AT&T") submits this *ex parte* regarding technical co-existence issues between terrestrial mobile 5G services and Fixed Satellite Services ("FSS") in the C-band. As discussed below, for FSS/5G co-existence, the Federal Communications Commission ("Commission" or "FCC") can and should adopt technical rules that fully protect FSS operations while limiting unnecessary and impractical obligations on 5G licensees by: (i) employing a Power Flux Density ("PFD") threshold for validating 5G harmful interference to FSS earth stations; and (ii) recognizing that 5G channels greater than 50 megahertz removed from the FSS band edge will have no measurable impact on earth station operation. The Commission should also address protection of grandfathered Telemetry, Tracking and Control ("TT&C") earth stations on a highly individualized basis, including requiring investments in site-specific interference management tools, and reject the potentially sweeping preclusive effect of the overbroad generic regulations on 5G deployments proposed by the C-Band Alliance ('CBA"). As a final matter, although the CBA plan to create "virtual" registrations for occasional use ("OU") FSS registrations for 500-700 venues across the country will address a breadth of OU applications, the plan is unlikely to prove satisfactory to C-band satellite users, as it still does not provide solutions for OU activities at temporary venues or the need to occasionally modify OU usage at existing venues. Moreover, it is unlikely to prove satisfactory to mobile broadband interests, as it could prevent 5G deployments on mid-band spectrum in areas where it would be in high demand. As a result, further study will be required to ensure that vital OU services can be preserved without unduly diminishing the utility of the band for terrestrial 5G services.

The Commission should utilize a PFD limit for FSS earth stations to validate claims of harmful interference and trigger remediation. CBA has proposed that protection of FSS earth stations from interference attributable to 5G services should be based on limiting Power Spectral Density ("PSD") to -128 dBm/MHz, a threshold measured after the receiver filter and before the

low noise block ("LNB").[1] CBA's proposal unrealistically relies on a threshold that is 10 dB below the noise floor and measurements taken at a relatively inaccessible location in the receiver system. Setting aside whether -128 dBm/MHz is the appropriate PSD to protect FSS operations,[2] equivalent protection can be derived by using a PSD and off-axis angle performance to calculate a PFD. Whether or not service degradation experienced by an FSS earth station owner is attributable to 5G operations can then be measured by reference to the PFD.

Specifically, AT&T recommends adopting a PFD limit of -124 dBW/m^2/MHz for 5G operations in the 50 megahertz immediately below the FSS band edge. AT&T's recommended limit assumes an off-axis angle of 20° or more, which AT&T believes should cover over 90% of the 5G to FSS earth station situations. Because earth station look angles approaching the 5° that CBA has suggested as relevant are largely limited to northern latitudes, in the rare cases where off-axis angles are below 20°, more stringent PFDs can easily be calculated.[3] In creating a PFD methodology, the Commission could also set regulatory expectations regarding out-of-band emissions ("OOBE") limits. Although not strictly required to calculate PFDs from a specified PSD, establishing OOBE limits will mitigate the variables associated with determination of the PFD and simplify that calculation.

Consistent with AT&T's analysis in its prior technical *ex parte*, and the follow-on CommScope study attached hereto as Exhibit A,[4] the CBA-proposed 40 km coordination distance should also be narrowed to no more than 4 km. In the attached study, CommScope undertook an analysis of the impact of AT&T's deployed sites in the San Francisco market on registered C-band earth stations in the area. In this analysis, CommScope analyzed satellite arc positions from 87° West to 139° West at 2° increments to determine aggregate impacts from 5G base stations for both in-band and out-of-band interference.

CommScope, as part of this study, looked at the appropriate coordination distance from each earth station. CommScope analyzed the earth stations in the SFO area to identify a radius for each where interference from at least one 5G base station crosses either the in-band or out-

[1] Reply Comments of the C-Band Alliance, GN Docket No. 18-122 (filed Dec. 7, 2018) (including Technical Annex as Exhibit) ("*CBA Technical Annex*") at Technical Annex, pp. 5-6.

[2] Some commenters have suggested that -128 dBm/MHz provides more protection than required to ensure FSS communications are not subject to harmful interference. *See, e.g.*, Comments of CTIA, GN Docket No. 18-122 at 8 (filed Aug. 7, 2019); Comments of Verizon, GN Docket No. 18-122 at 8-9 (filed Aug. 7, 2019). For purposes of this analysis, AT&T is arguing that, regardless of the PSD that is ultimately deemed suitable, the PSD should be converted into a more pragmatic regulatory criterion, such as PFD. AT&T has used -128 dBm/MHz for purposes of this analysis as a reference, but takes no position on whether that is the appropriate threshold for FSS protection.

[3] Indeed, for the few FSS earth stations with look angles that are very low, earth station-specific PFDs could be approved by the Commission. 5G deployment could also be subject to a technical rule requiring sound engineering practices be employed in siting, such as avoiding combinations of location and antenna height that would place a 5G radiator within the main beam of an earth station receiver.

[4] Letter from Henry Hultquist, Vice President – Federal Regulatory, AT&T Services, Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 18-122 at Attachment "C-Band Fixed Satellite Services/5G Co-Existence" p. 12 (filed May 23, 2019) ("*AT&T May 23 Letter*").

of-band protection threshold. For this portion of the analysis, CommScope used -40 dBm/MHz for 5G out-of-band emissions and, for in-band interference, assumed FSS filter attenuation of 43 dB, as proposed by CBA, at a 20 megahertz offset. In situations where aggregate interference from multiple 5G base stations crossed the protection threshold, the base stations were ranked based on their interference to the earth station in descending order, and the least number of base stations were identified for removal to calculate aggregation in a way that the total interference fell below the protection threshold. The coordination radius is based on the identified base station that is furthest from the corresponding earth station, and area shown below in *Figure 1*, for in-band, and *Figure 2*, for out-of-band.

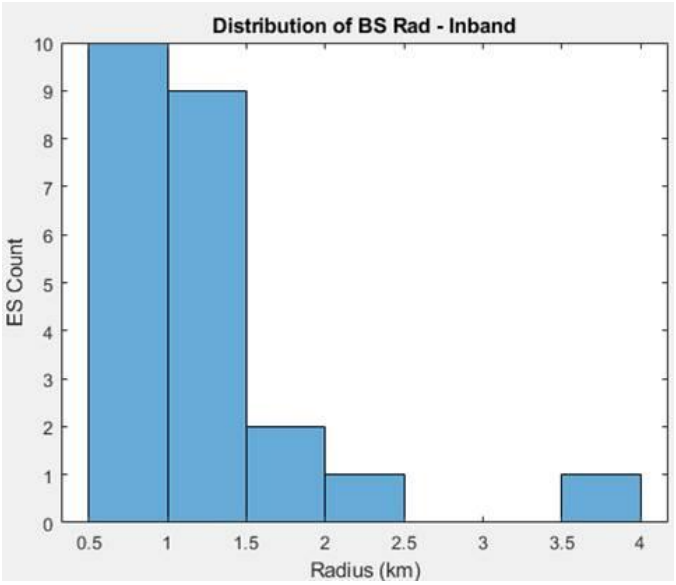


Figure 1: Distribution of interfering base stations around earth stations for in-band scenario

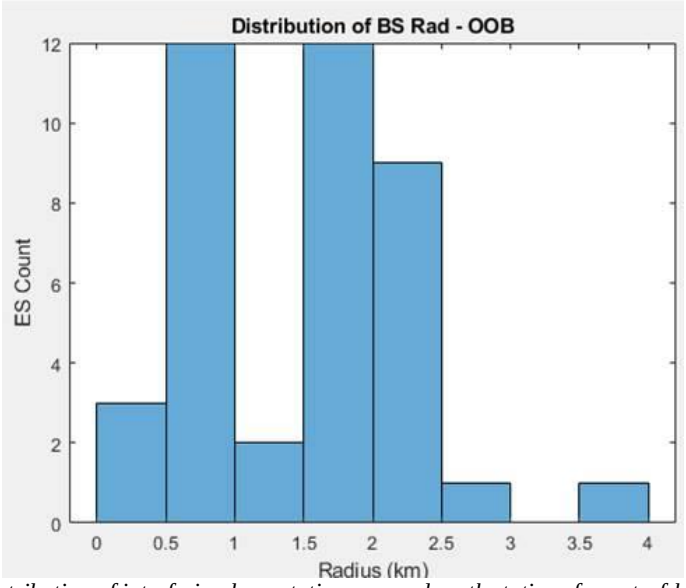


Figure 2: Distribution of interfering base stations around earth stations for out-of-band scenario

CommScope's analysis, using real world data and proposed out-of-band limits at a 20 megahertz offset, demonstrates that a coordination zone of 4 km is sufficient to protect C-band FSS earth stations from harmful interference (and also supports AT&T's proposal that 5G base stations beyond 50 megahertz from the FSS band edge do not require coordination). Importantly, reducing the coordination *radius* by a factor of 10 reduces the coordination *area* by a factor of 100, which tangibly reduces impediments to 5G roll-out.

AT&T is continuing to research ways to quantify the interference from 5G transmissions attributable to different blocks of spectrum within the adjacent 50 megahertz while imposing the most minimal burden on 5G deployments. For example, AT&T previously suggested, and continues to support, permitting some constrained operation in spectrum that is within 20 megahertz of the FSS band edge instead of designating a fallow guard band. At the same time, imposing requirements on licensees that require deeply integrated calculations of aggregate impact is burdensome, potentially anticompetitive, and possibly unnecessary to address if—as most anticipate—the repurposed C-band spectrum is used with very broad (80 megahertz or more) channels. In any event, the Commission can move forward by adopting PFD-based protection for FSS users and require the 5G industry to determine a cooperative mechanism for attributing and allocating rights among licensees within the adjacent 50 megahertz.

The Commission should, however, avoid imposing onerous deployment restrictions on 5G licensees more than 50 megahertz removed from the FSS band edge. 5G transmissions further than 50 megahertz from the FSS band edge will be severely attenuated and will have negligible contribution to potential FSS interference. For the operators outside of 50 megahertz, the -60 dB/MHz OOBE specification is sufficient to protect FSS earth stations in realistic 5G deployments.[5] AT&T, in fact, provided the results of a study by CommScope that used AT&T's own existing network base station architecture and the FCC's database of registered C-band earth station locations (and associated technical data) to calculate interference impacts in real world conditions.[6] CommScope's study concluded that, "in cases where the CBA's proposed thresholds were exceeded, the interference was dominated by a single 5G base station, and not

[5] Comments of the C-Band Alliance, GN Docket No. 18-122 at 9 (filed Oct. 29, 2018) ("CBA Comments") (stating that "-60 dBm/MHz beyond 40 MHz outside the band edge is necessary to protect earth stations against the aggregate effect of [OOB] emissions of multiple base stations"). The original emissions mask outlined by the CBA in their comments required 5G base stations to attenuate their signal to -60 dBm/MHz at a 50 MHz offset. This correlates with the CBA's proposal at the time, which specified a 50 MHz guard band, a proposal that was subsequently modified in the CBA's reply comments. Other commenters have proposed that -50 dBm/MHz should be adequate to protect FSS earth station from 5G OOB emissions, *see* Letter from Mark Racek, Sr. Director, Spectrum Policy, Public Affairs and Regulations, Ericsson, to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 18-122 at 3 (filed Apr. 26, 2019) (noting that "Ericsson conducted an adjacent channel study that confirms that coexistence is feasible with a 20 MHz guard band and an OOBE limit of -40 dBm/MHz plus an additional 10 dB shielding or clutter loss at the FSS earth station antenna"); *see also* Reply Comments of Ericsson, GN Docket No. 18-122 at 7 (filed Dec. 11, 2018); *Technical Appendix*: 5G and FSS Coexistence Simulations, Nokia Bell Labs, attached to Comments of Nokia, GN Docket No. 18-122 (filed Oct. 29, 2018).

[6] *See AT&T May 23 Letter* at Attachment "C-Band Fixed Satellite Services/5G Co-Existence."

by aggregate effect," which strongly supports AT&T's view that the adjacent and near adjacent band users will be the significant contributors if interference arises.[7]

Protection of designated TT&C sites must be addressed on an individualized basis. CBA has argued that there have to be four TT&C sites in the CONUS. According to CBA, these sites need to retain rights to protection across the full 500 MHz of existing C-band spectrum, require protection to a PSD threshold of -133 dBm/MHz, and, as a result, need a massive 150 km coordination zone.[8]

Acknowledging the implications to 5G deployment from this proposal, CBA has stated that the grandfathered sites could be relocated to remote locations, and offered some potential candidates. However, assuming use of CBA's proposed coordination zone, at least one of these "remote" candidate sites—Hawley, PA[9]—would impact millions of consumers, including residents of New York City, NY; Trenton, NJ; and other major urban areas. As shown below, this proposal is untenable and should be rejected:

[7] *Id*. at 12. Just as in other technical regulations, artificial cases can be constructed that place 5G transmitters in the main lobe of an earth station receiver, which may result in predicted harmful interference from sources that are more than 50 MHz from the FSS band edge, *see, e.g.*, Comments of C-Band Alliance, GN Docket No. 18-122 at 22-24 (filed Aug. 7, 2019) ("*CBA Other Issues Comments*"). However, as AT&T has suggested with respect to the treatment of satellite look angles generally, those situations would be better addressed by requiring 5G licensees to use sound engineering practices for siting, including avoiding combinations of site location and antenna height that would result in 5G operation in the main beam of an earth station receiver.

[8] *CBA Technical Annex* at 7; Letter from Jennifer D. Hindin, Counsel for the C-Band Alliance, to Ms. Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 18-122 at Transition Plan, p. 10 (filed Apr. 9, 2019) (including C-Band Alliance Transition Implementation Process as Exhibit) ("*Transition Plan*"). CBA's August 7 *ex parte* seems to imply that some co-channel FSS operations should only be protected at the -128 dBm/MHz threshold rather than the -133 dBm/MHz threshold, although the CBA still refers to the thresholds applying to "earth stations," rather than particular classes of communications at earth stations. Letter from Jennifer D. Hindin, Counsel for the C-Band Alliance, to Ms. Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 18-122 at Exhibit, p. 3 (filed Aug. 7, 2019).

[9] *CBA Other Issues Comments* at 30 n.80.

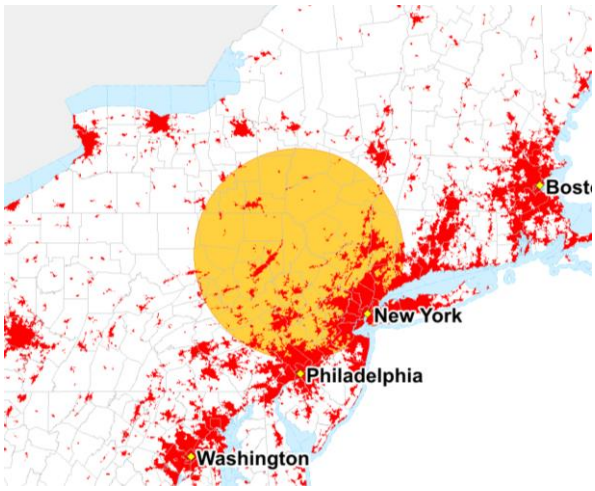


Figure 3: 150 km zone surrounding Hawley, PA

Because there are only a small number of sites to be protected, and because the costs of relocating these sites can be treated as part of the transition plan budget, sound public policy suggests treating these sites on a highly individualized basis and requiring implementation of measures that might be considered extraordinary under other circumstances:

- CBA should commit to the minimum possible number of locations, and locations should be selected with reference to how limited an impact the sites would have, not with reference to the local population at each site nor the operator's relocation costs (which should be compensated).[10]

- The impact of the individual sites should be further minimized through use of natural and constructed shielding to further limit the potential for adverse 5G impacts.

- The sites should use larger, more directional antennas (*e.g.*, 13-meter dishes) to increase the received signal strength and improve rejection of noise from undesired sources.

- The actual frequencies used specifically for TT&C should be provided for each site, which should be only approximately 10 MHz in the lower portion of the band, not the entire 500 MHz band.

Taking the effects of these measures into consideration, 5G licensees can derive specific PFDs for each band defined for each site. With respect to relocation and upgrade costs for TT&C sites,

[10] AT&T agrees with Verizon that "[p]lacement of a TT&C earth station in a small town does not necessarily minimize its impact on MBX licensees." Letter from William H. Johnson, Senior Vice President – Federal Regulatory and Legal Affairs, Verizon, to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 18-122 at Ex. 1 p. 14 (filed Sept. 16, 2019).

the guiding principle should be that upgrading a few facilities—where the upgrades are paid for through the transition fund—should be a preferred solution to implementing low cost TT&C facilities that can interfere with or impair 5G deployment for millions of users.

The regulatory scheme for the reallocation of the C-band must address the needs of occasional use FSS applications. As CBA and others have recognized,[11] not all C-band FSS use is at permanent fixed locations—there is a not insignificant amount of C-band capacity that supports occasional use ("OU") applications. These applications include temporary fixed operations for high value video and audio broadcasts from political, cultural or sporting venues, and other events, as well as emergency backhaul and interconnection for network restoration after, for example, hurricanes and floods. Obviously, the lack of a pre-determined location for the FSS earth stations supporting OU complicates FSS/5G sharing.

CBA, for its part, has proposed that the Commission, working with stakeholders, identify the venues where transportables are likely to be used, where at the venue such use would take place, and register the likely temporary location in IBFS as a "venue earth station" that would be treated like any other permanent earth station.[12] CBA estimates between 500 and 700 such venues exist in CONUS.

Although AT&T believes there is some merit in this proposal, concerns remain regarding co-existence between 5G and FSS at these venues and use of transportable FSS earth stations more generally.

- The "venue earth station" locations described in CBA's proposal involve areas that support key use cases for 5G. FSS OU operations must be implemented in a way that do not impair robust, extensive 5G coverage at these venues.

- The transition should include, and budget for, customized filters as well as facility modifications that further improve protection from 5G emissions in close proximity to transportable antennas.

- Fixed registrations for "venue earth stations" do not address all OU applications, and even where fixed sites are identified, OU transmissions may change over time. The pre-registered venue proposal, for example, does not address emergency restoration activities, high value broadcasts from locations that are unanticipated (*e.g.*, a Presidential debate taking place at a high school), or changes in urban patterns that may result in new sports and entertainment venues. Similarly, the proposal does not address situations where OU

[11] *See, e.g.*, Letter from Jennifer D. Hindin, Counsel for the C-Band Alliance, to Ms. Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 18-122 at Transition Plan, p. 10 (filed Apr. 9, 2019) (including C-Band Alliance Transition Implementation Process as Exhibit) ("*Transition Plan*").

[12] Letter from Jennifer D. Hindin, Counsel for the C-Band Alliance, to Ms. Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 18-122 at 2 (filed Sept. 18, 2019).

sites at a registered venue must change because of new construction that obscures the earth station's southern view, or where the location itself is converted to another use.

- CBA proposes that new proposed sites to house transportables will need to coordinate with local 5G licensees, but further clarity is necessary regarding how this process will take place, which entities will bear the costs of re-engineering, and what recourse will exist in the event that OU sites are not available.

Obviously, all of these concerns are easier to address if CBA commits to repack OU into the highest portion of the remaining C-band FSS spectrum. By maximizing the spectral distance between FSS OU operations and 5G networks, there is a much higher probability both that these facilities can co-exist without impairment and that whitespace can be found that would allow expansion of such use beyond registered locations.

* * *

As discussed above, the record still reflects a number of unresolved technical sharing issues. AT&T believes that a workable threshold for validating FSS earth station interference and minimizing the impact of TT&C facilities on 5G deployment represent tangible progress, and that certain issues, such as allocation of interference mitigation burdens among 5G licensees within 50 megahertz of the FSS band edge, can be addressed cooperatively going forward. However, the Commission must still adopt technical regulations for adjacent and co-channel protection, including any obligations that would limit 5G deployment on the northern or southern border, sufficient to provide prospective 5G licensees with a definitive package of rights prior to any C-band spectrum sale.

Should any questions arise concerning this *ex parte*, please do not hesitate to contact me at (202) 457-2055.

Sincerely,

/s/ Michael P. Goggin

Michael P. Goggin

COMMSCOPE®

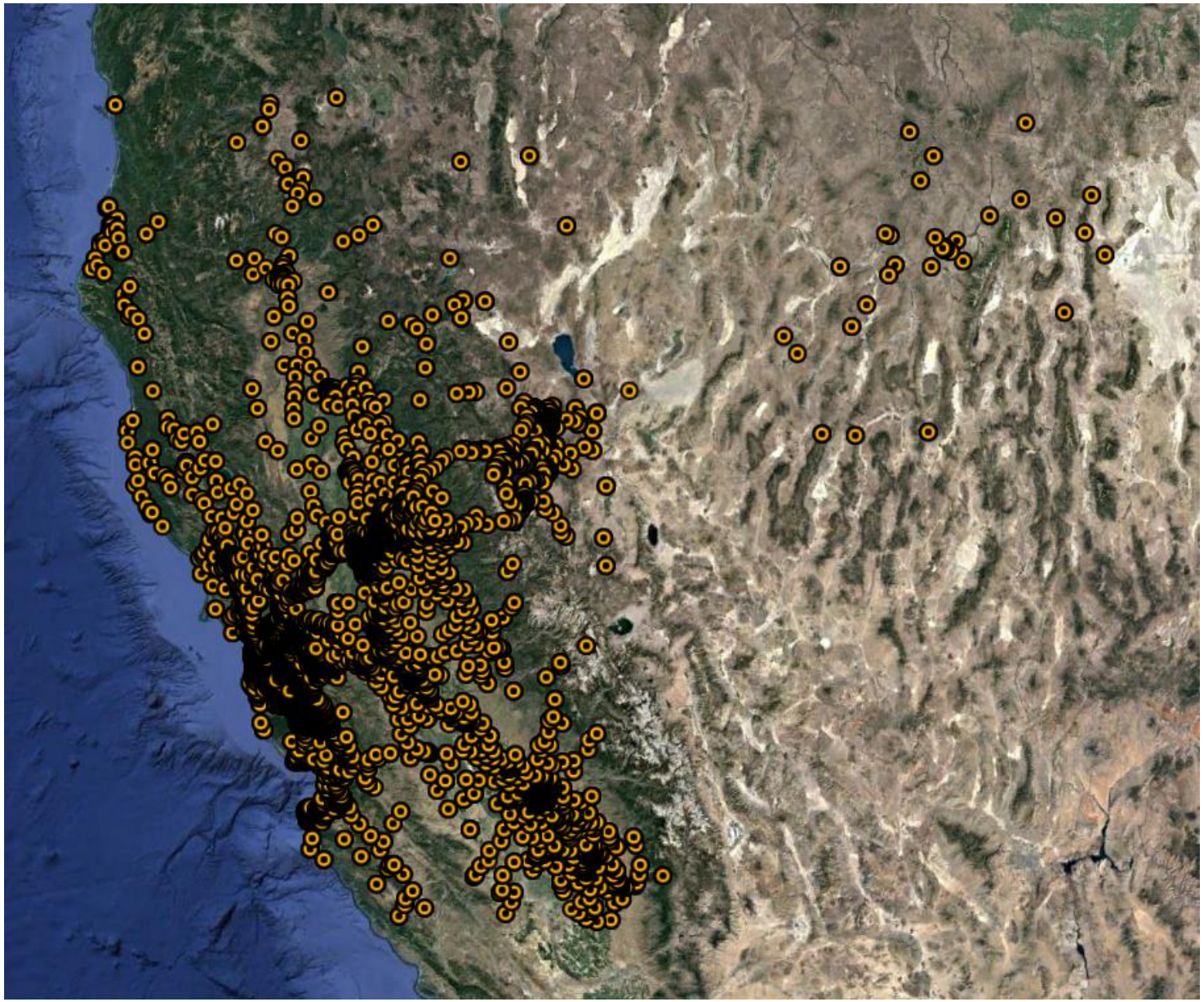
C-Band CBA proposal Analysis (SFO Market) 3-D Antenna Pattern - For AT&T

Oct 21, 2019

Navin Srinivasan

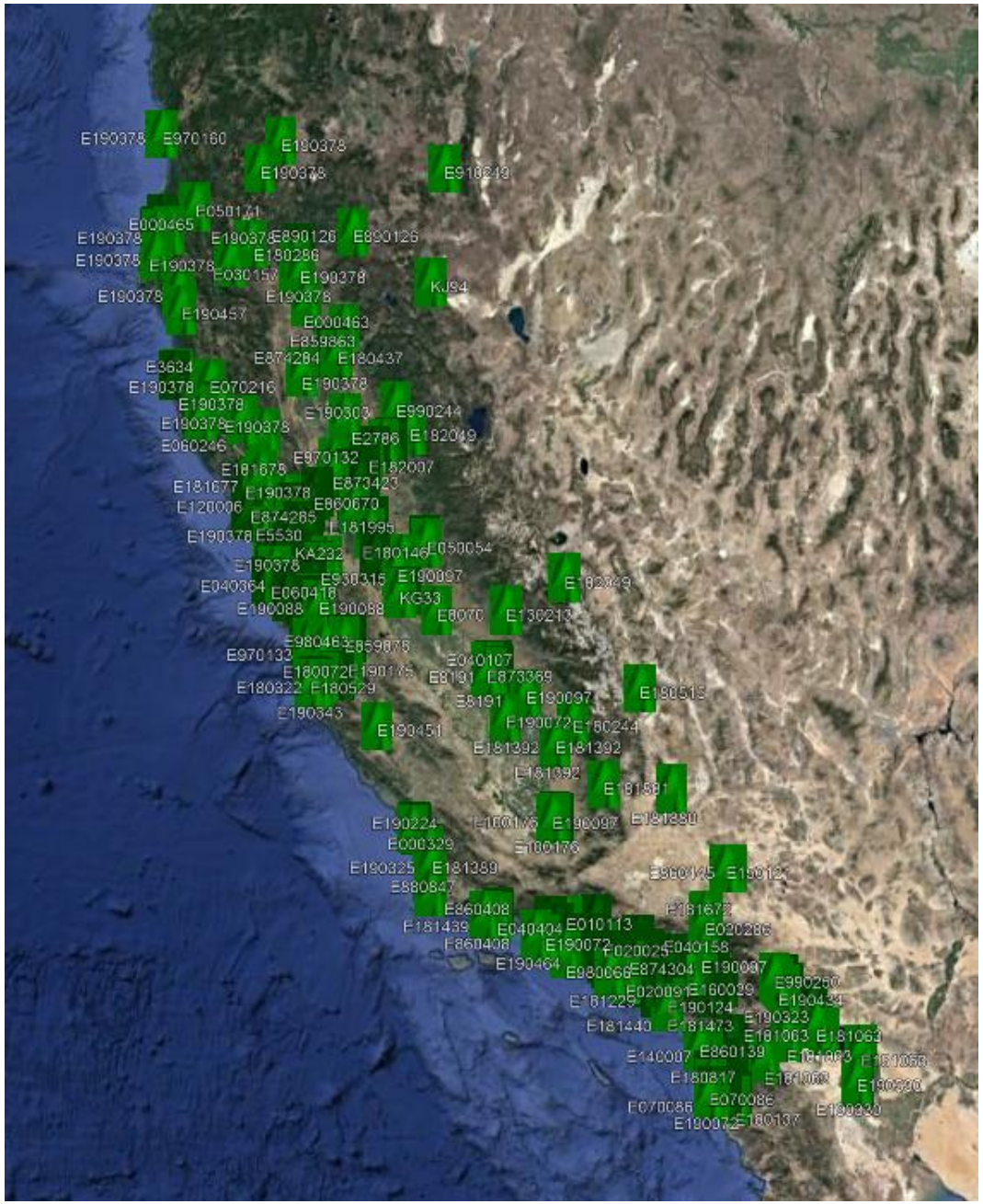
Ariful Hannan

BS Deployment



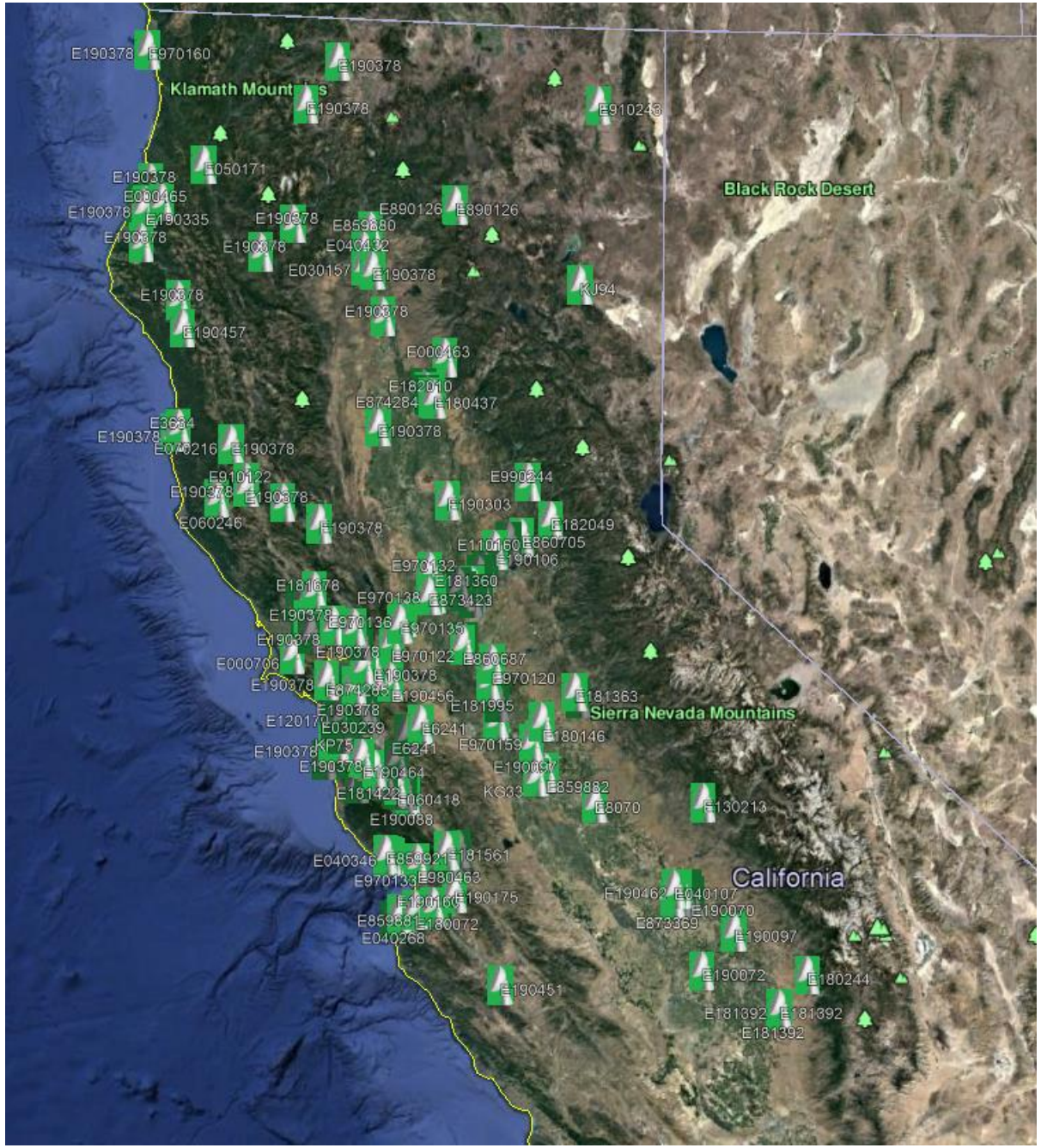
ES Locations

- Satellite Arc positions (Orbital Slots) for analysis
  - 87W to 139 W at 2 degree increments



ES Analyzed

- **257** ES locations analyzed
  - Includes All ES in the C-Band ES list provided



Analysis Assumptions

General: BS Antenna, Satellite Arc

- **Antenna**
  - Antenna model used for the BS
    - CommScope 3.8GHz antenna
    - Model: SSPX310R-V2
      - 65° HPBW
      - 6.8° vertical beamwidth
  - BS antenna down tilt value was derived from the *M_Tilt* and *E_Tilt* values from the BS deployment data
    - *bsAntDwnTilt = M_Tilt + E_Tilt*
- **Satellite Arc**
  - Satellite arc used: 87W to 139W
    - Analysis was done for satellite positions at 2 degree increments in the arc

Antenna for BS

SSPX310R-V2

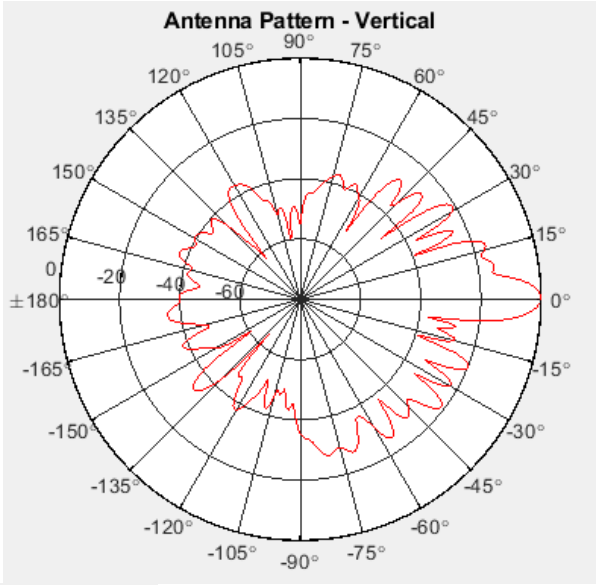
SSPX310R-V2

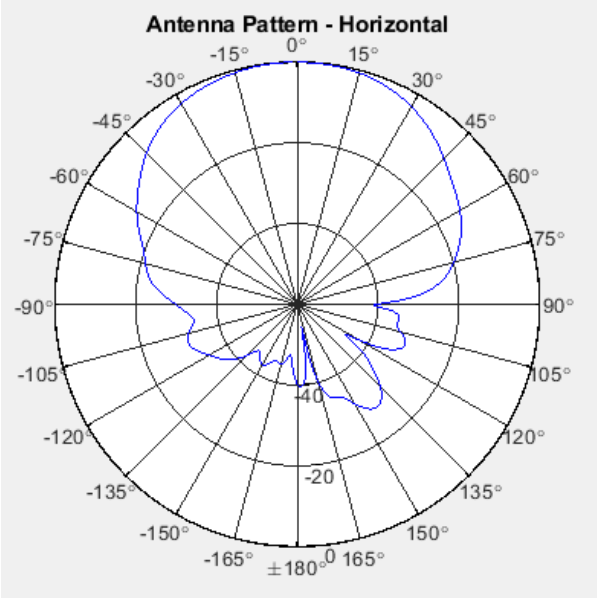
4-port sector antenna, 4x 3300–3800 MHz, 65° HPBW, 2x RET with manual override

- Integrated Internal Remote Electrical Tilt (RET), with independent control of electrical tilt with manual override on all arrays

Electrical Specifications

Frequency Band, MHz	3300–3550	3550–3800
Gain, dBi	17.7	18.0
Beamwidth, Horizontal, degrees	64	61
Beamwidth, Vertical, degrees	7.3	6.8
Beam Tilt, degrees	0–10	0–10
USLS (First Lobe), dB	23	24
Front-to-Back Ratio at 180°, dB	33	32
Isolation, Cross Polarization, dB	30	30
VSWR | Return Loss, dB	1.43 | 15.0	1.43 | 15.0
PIM, 3rd Order, 2 x 20 W, dBc	-140	-140
Input Power per Port, maximum, watts	150	150
Polarization	±45°	±45°
Impedance	50 ohm	50 ohm





3-D Antenna Pattern

Equation

- Horizontal and Vertical pattern obtained from the manufacturer data sheet
- 3-D antenna gain was derived from the H and V pattern
  - Used the 3GPP recommended method for combining
  - Max Attenuation (A_m) was limited to 50 dB

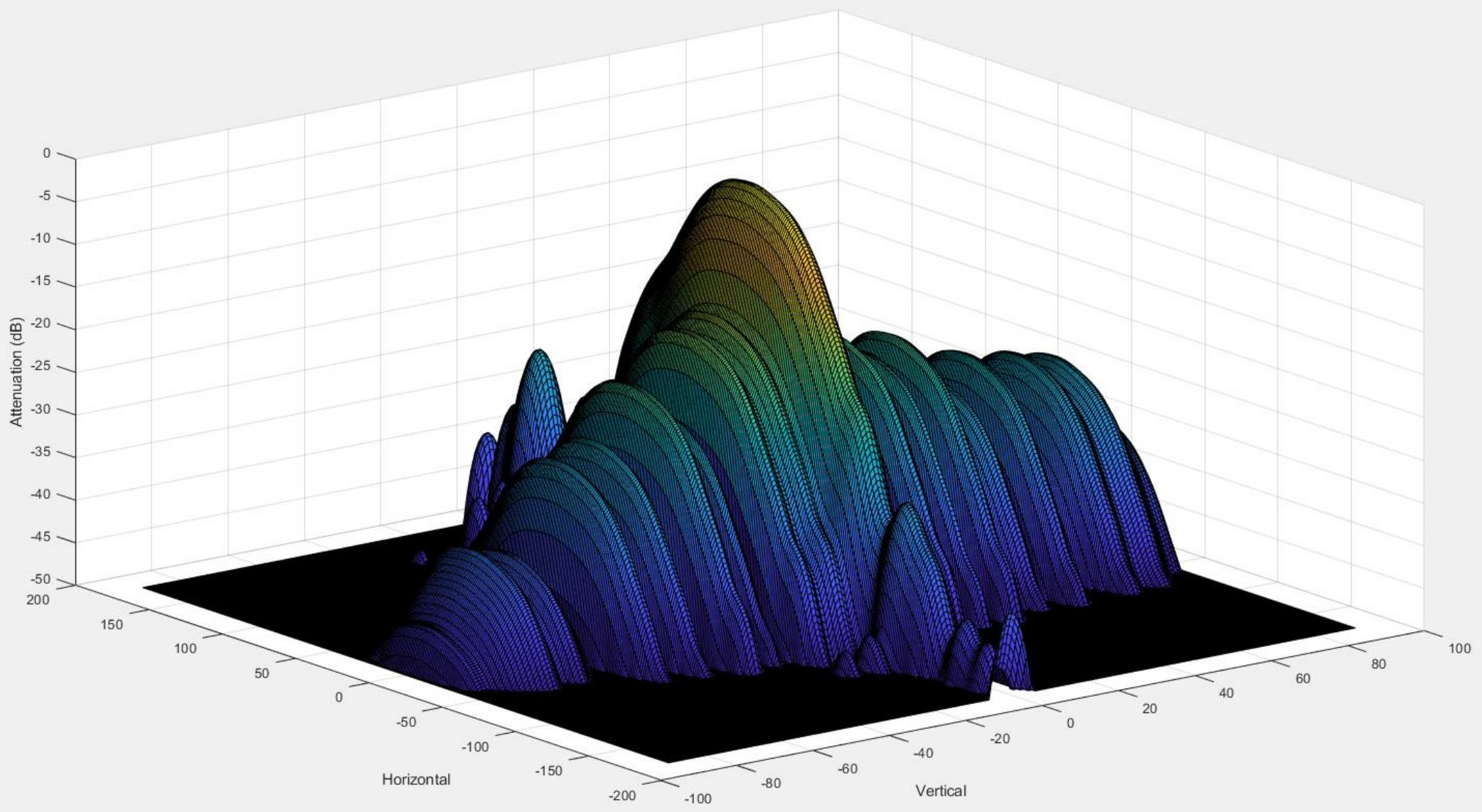
Combining method for 3D antenna element pattern (dB)		$A''(\theta'', \phi'') = -\min\left\{-\left[A_{E,V}(\theta'') + A_{E,H}(\phi'')\right], A_m\right\}$

Reference:

[1] 3GPP TR 36.873 V12.7.0 (2017-12) Technical Specification Group Radio Access Network; Study on 3D channel model for LTE (Release 12)

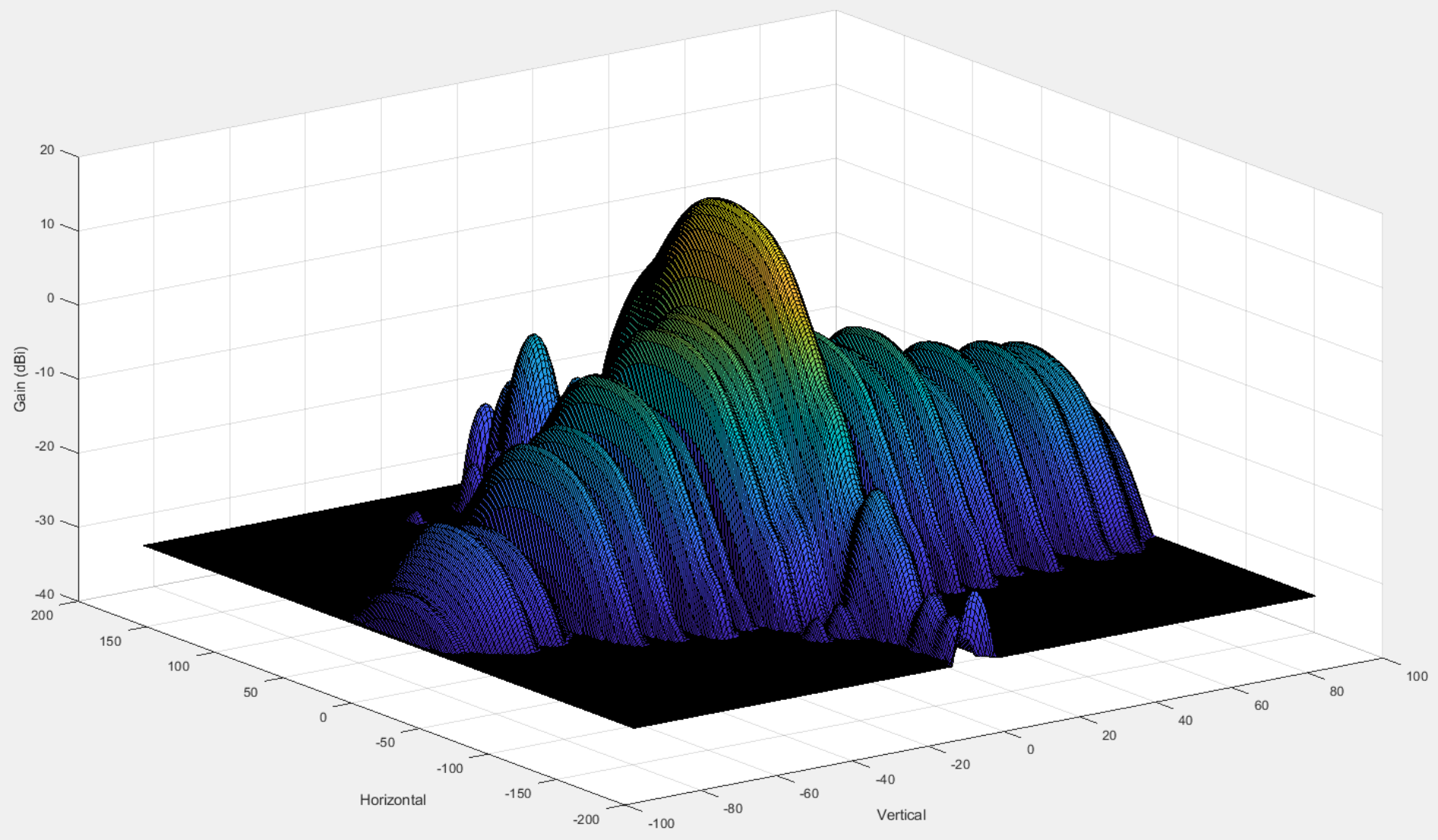
3-D Antenna Pattern for BS

Attenuation Plot (SSPX310R-V2)



3-D Antenna Pattern for BS

Gain Plot (SSPX310R-V2)



COMMSCOPE®

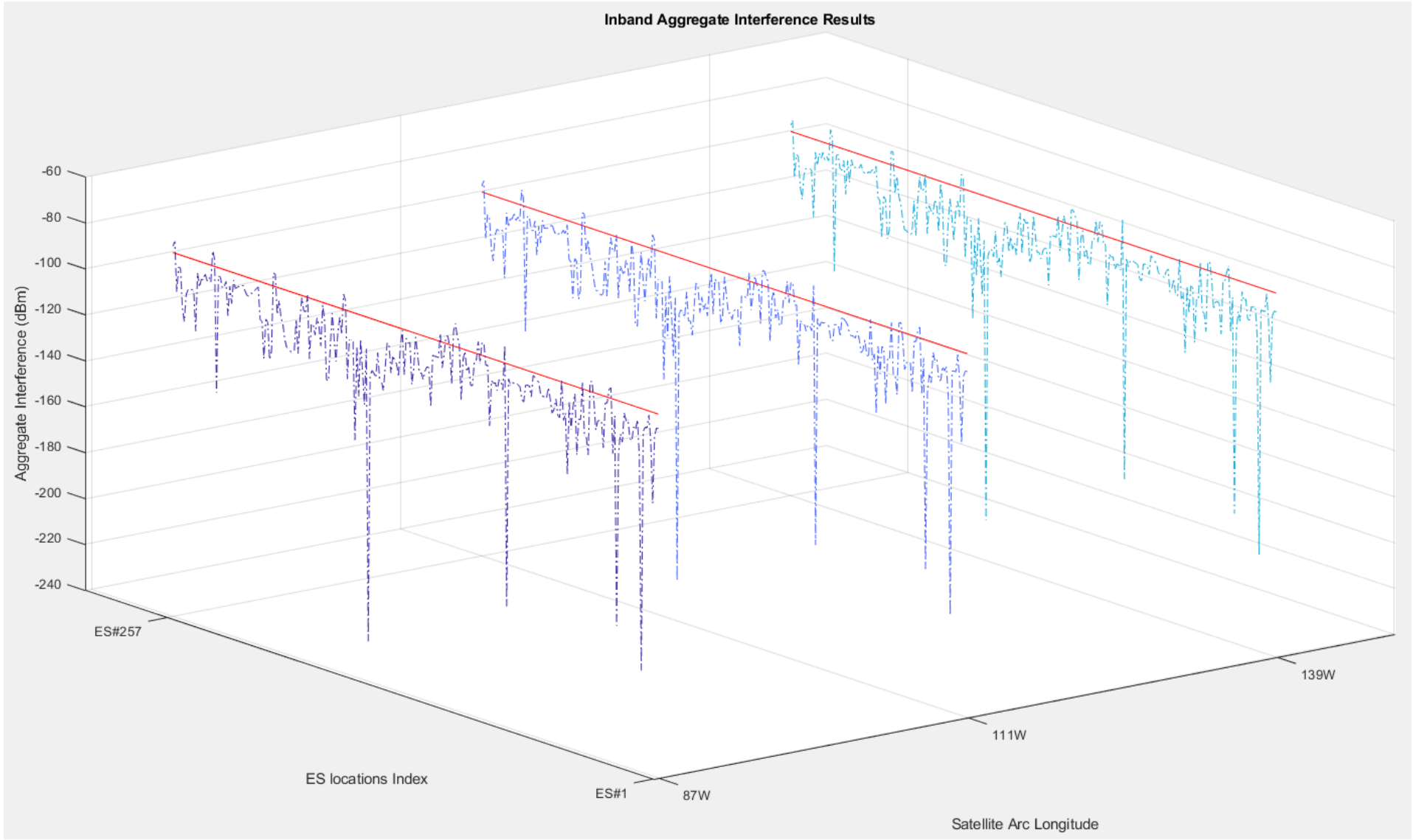
Protection Analysis: Inband

Analysis Assumptions
In Band Analysis

- Base Station EIRP is 75 dBm/10 MHz channel in rural areas
- Base Station EIRP is 72 dBm/10 MHz channel in other areas
- Protection assessed only at the location of the registered FSS earth stations

Interference Test Results

Inband Analysis



Revised

Interference Test Results

Inband Analysis

Of the 257 ES analyzed, the plots below provides the number of ES(Figure A), and the percentage(Figure B), where the interference from the BSs crosses the CBA-proposed threshold

Figure A

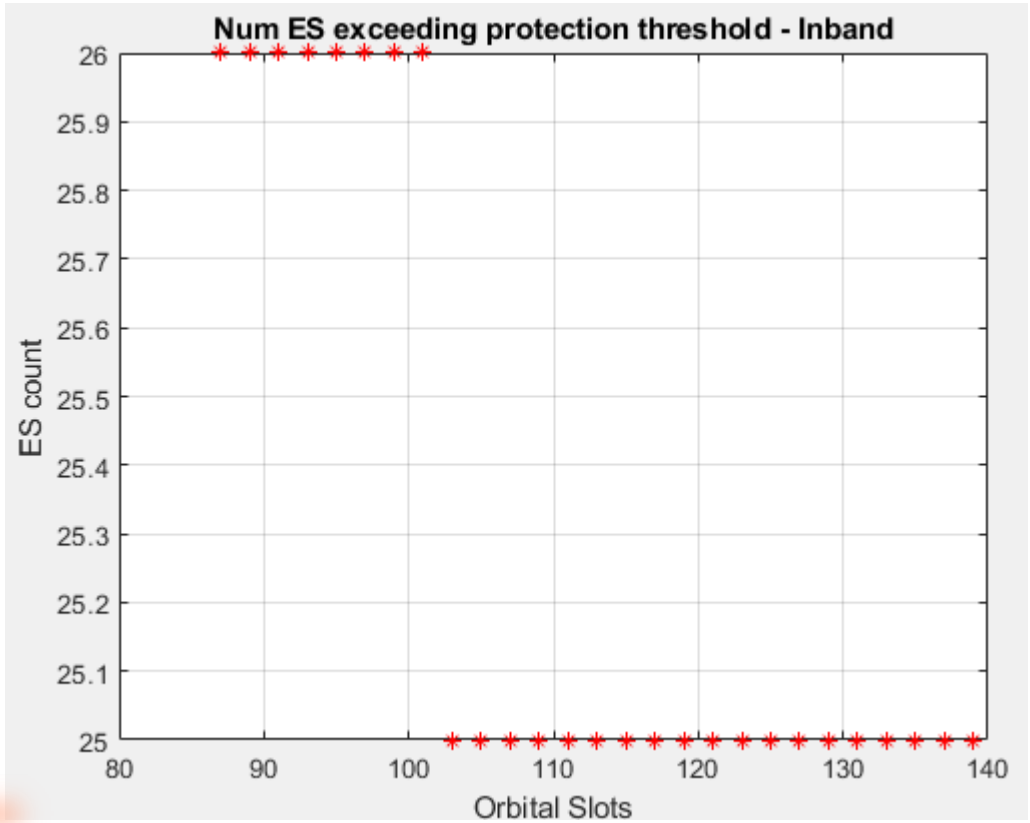
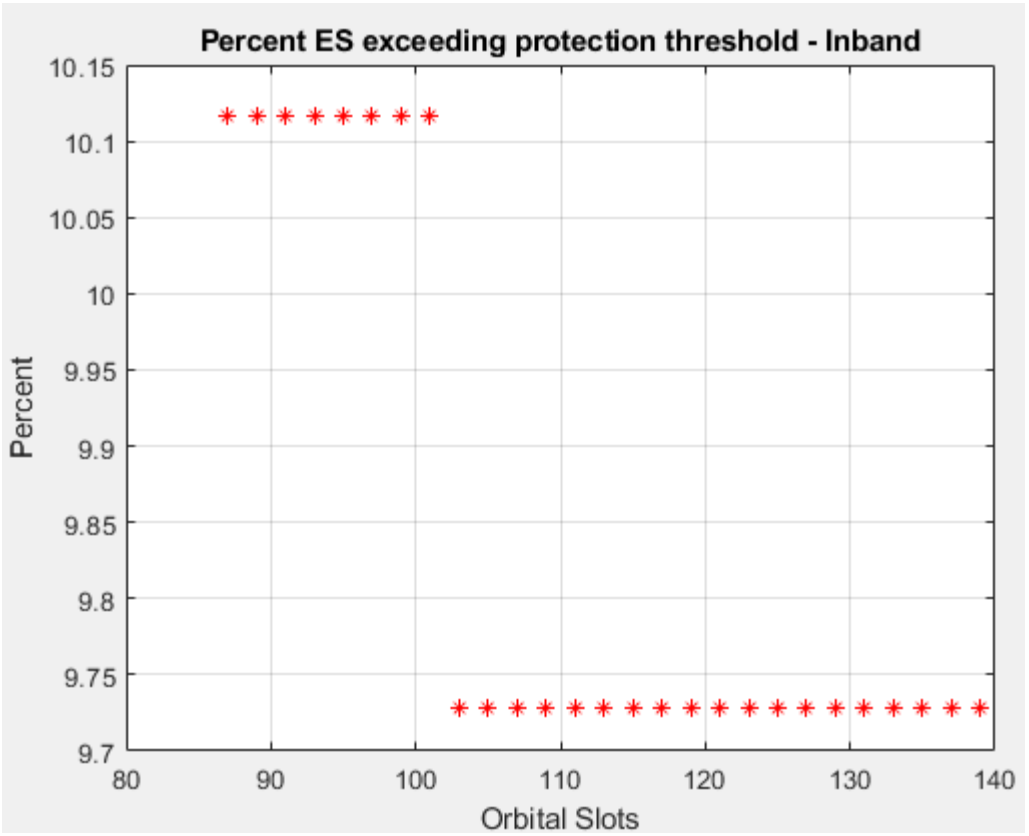


Figure B



Revised

COMMSCOPE®

Protection Analysis: Out of Band (OOB)

COMMSCOPE®

BS OOB Emission into ES: -40 dBm/MHz

Analysis Assumptions
Out of Band (OOB) Analysis

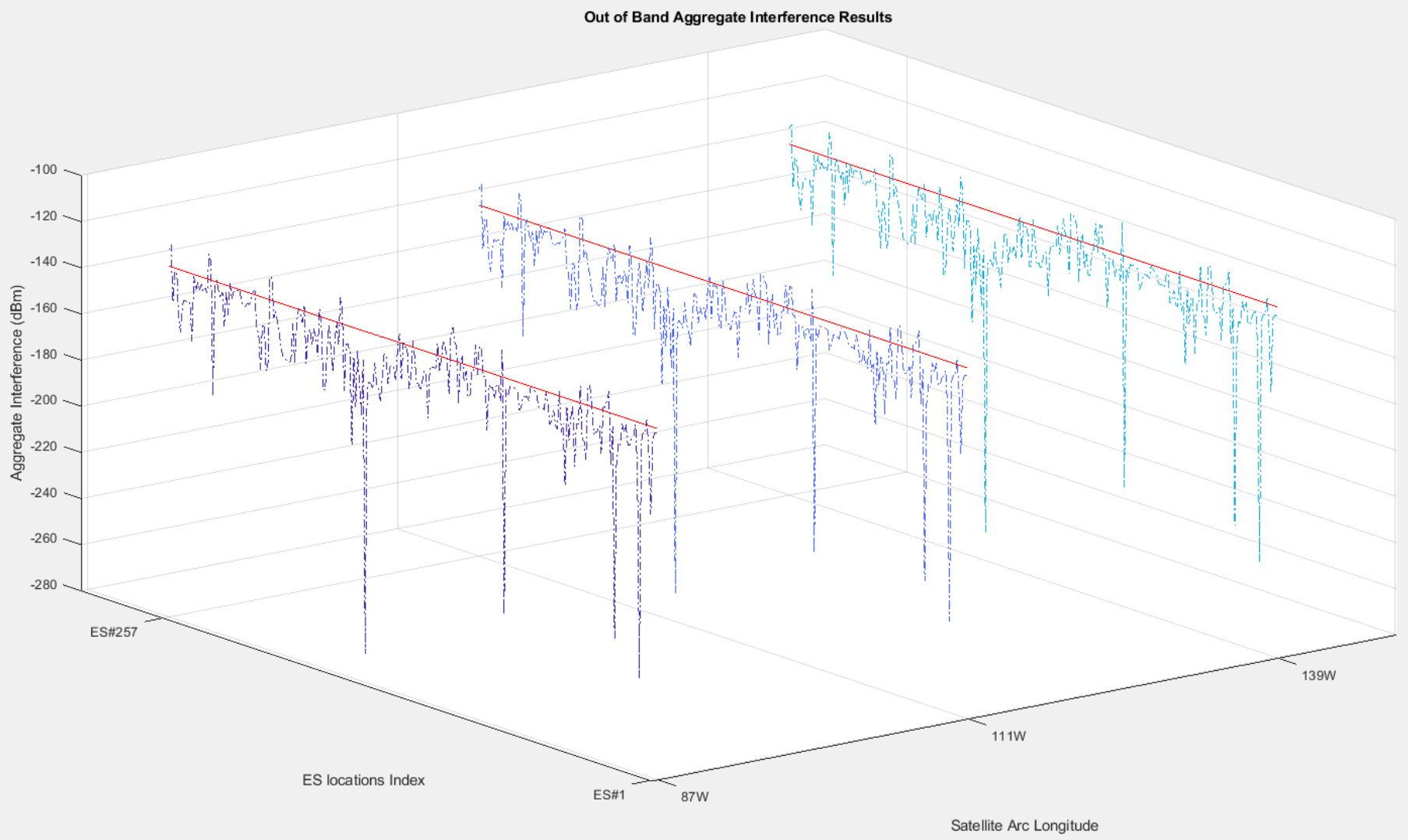
- Base Stations are transmitting at 3865 – 3875 MHz
  - BS OOB Emission power into the FSS passband (3900 – 4200 MHz): -40 dBm/MHz
- Protection assessed only at the location of the registered FSS earth stations

Note:

The analysis is performed for all C-Band ES using the -128 dBm/MHz ignoring the TT&C protection level

Interference Test Results

OOB Analysis (Emission into ES: -40 dBm/MHz)



Interference Test Results

OOB Analysis (Emission into ES: -40 dBm/MHz)

Of the 257 ES analyzed, the plots below provides the number of ES (Figure A), and the percentage (Figure B), where the interference from the BSs crosses the CBA-proposed threshold

Figure A

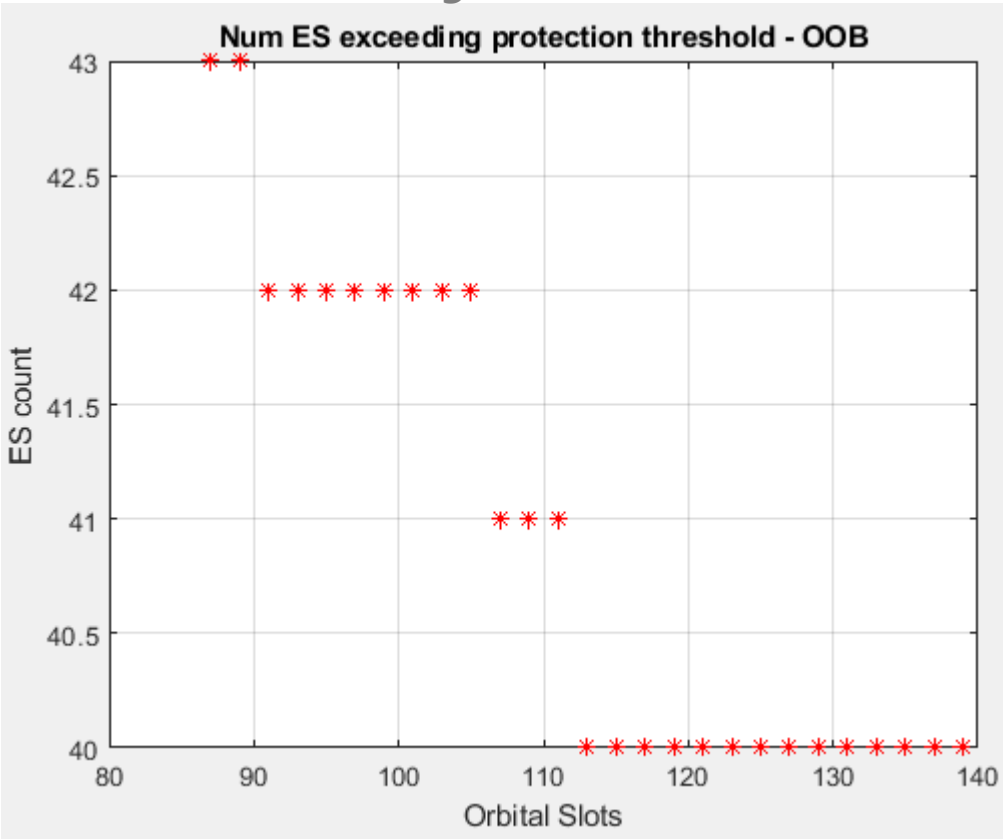
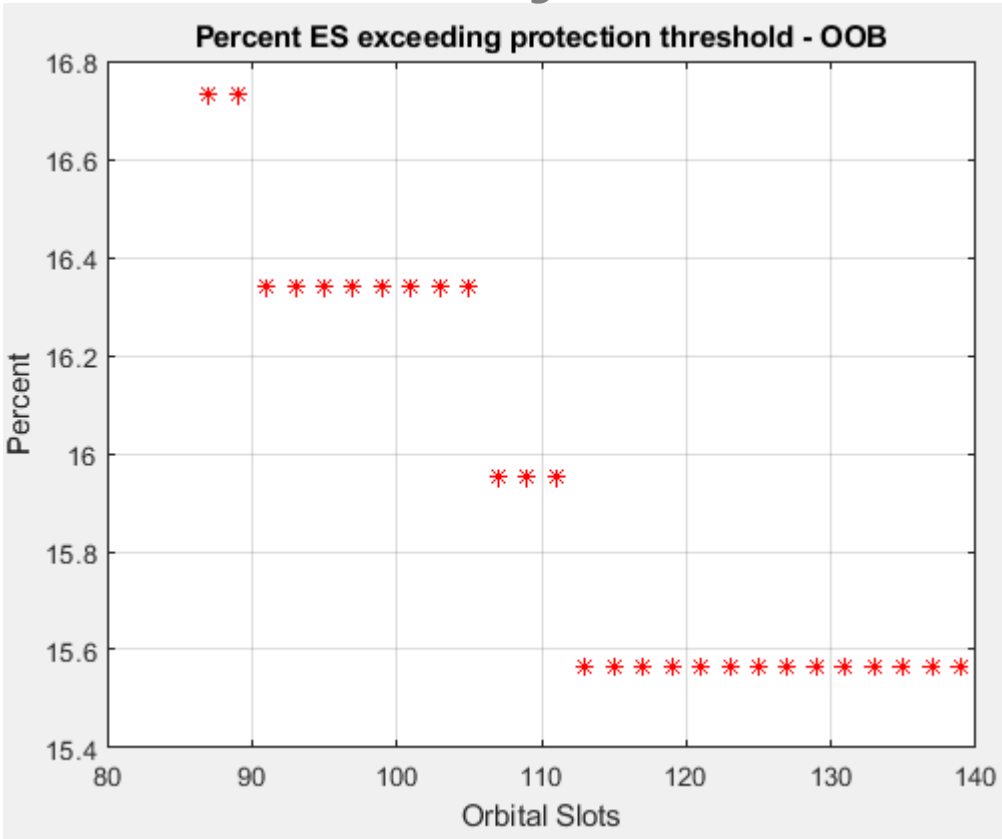


Figure B



COMMSCOPE®

BS OOB Emission into ES: -50 dBm/MHz

Analysis Assumptions
Out of Band (OOB) Analysis

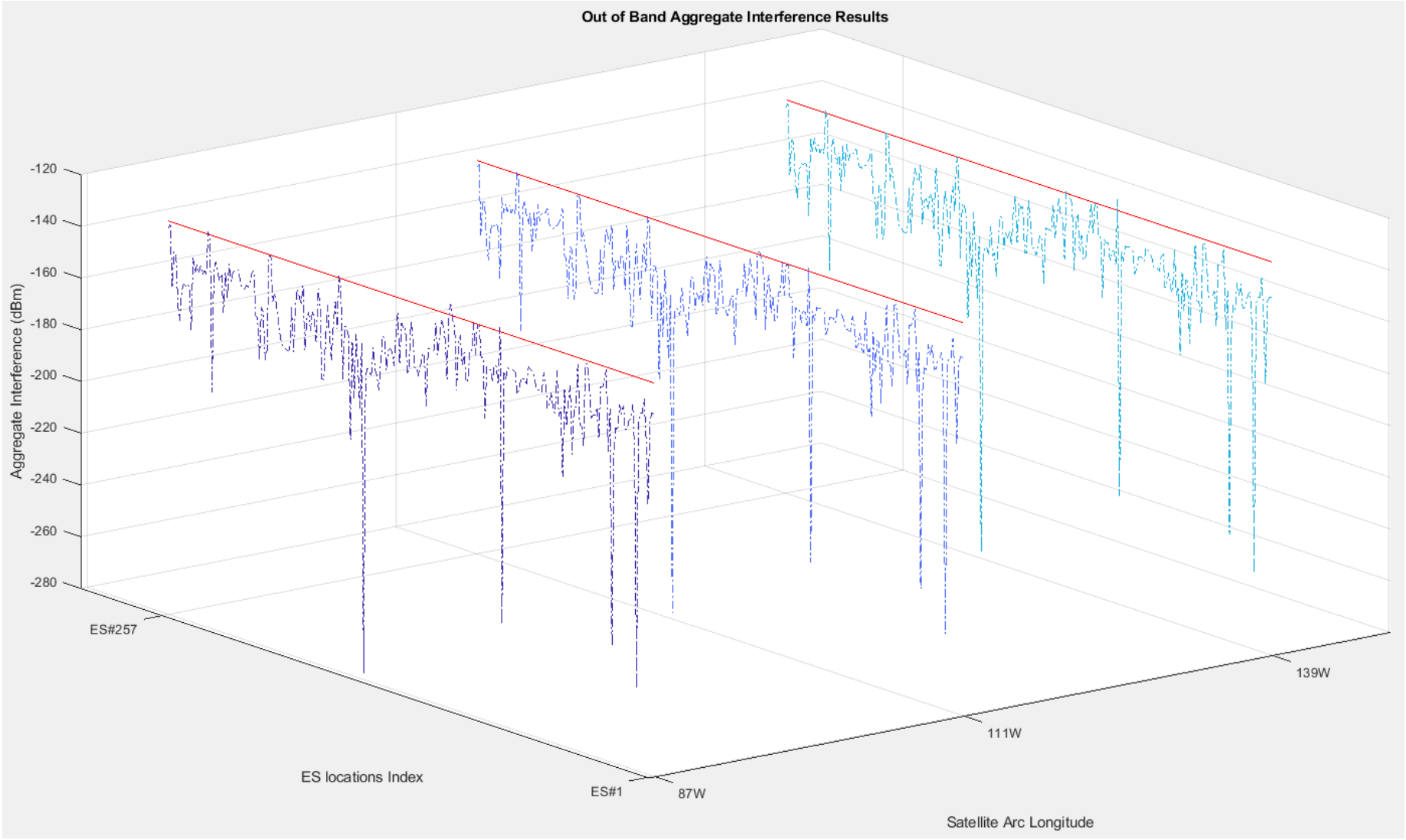
- Base Stations are transmitting at 3795 – 3805 MHz
  - BS OOB Emission power into the FSS passband (3900 – 4200 MHz): -50 dBm/MHz
- Protection assessed only at the location of the registered FSS earth stations

Note:

The analysis is performed for all C-Band ES using the -128 dBm/MHz ignoring the TT&C protection level

Interference Test Results

OOB Analysis (Emission into ES: -50 dBm/MHz)



Interference Test Results

OOB Analysis (Emission into ES: -50 dBm/MHz)

Of the 257 ES analyzed, the plots below provides the number of ES(Figure A), and the percentage (Figure B), where the interference from the BSs crosses the CBA-proposed threshold

Figure A

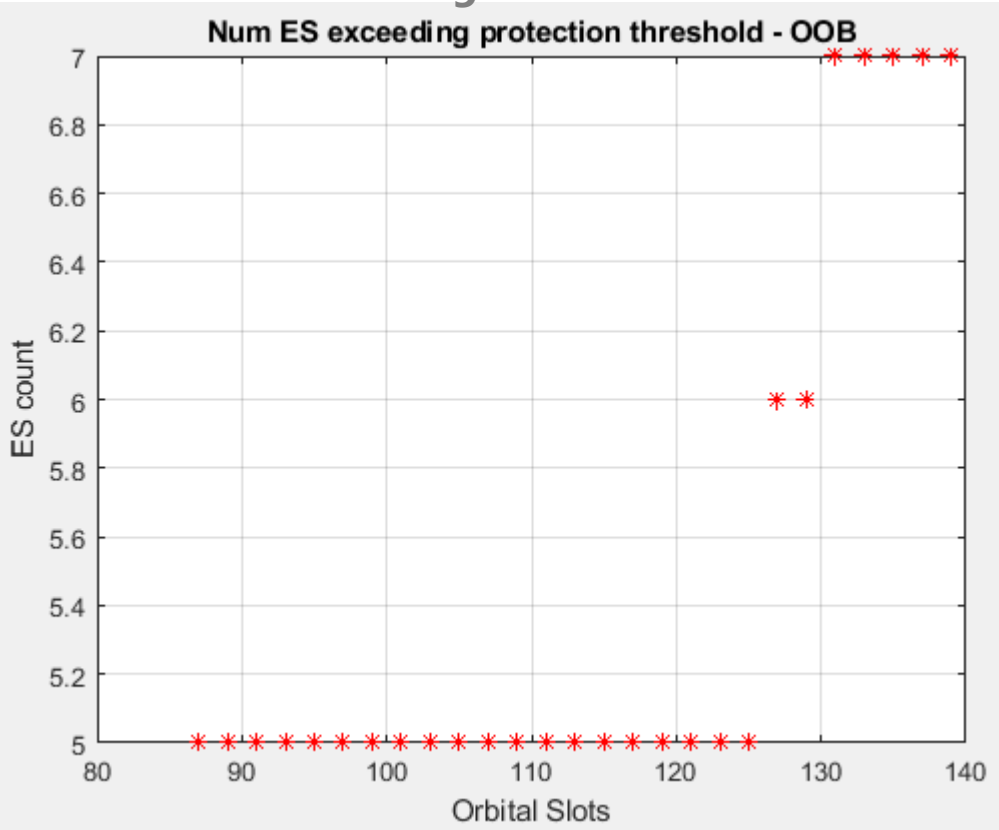
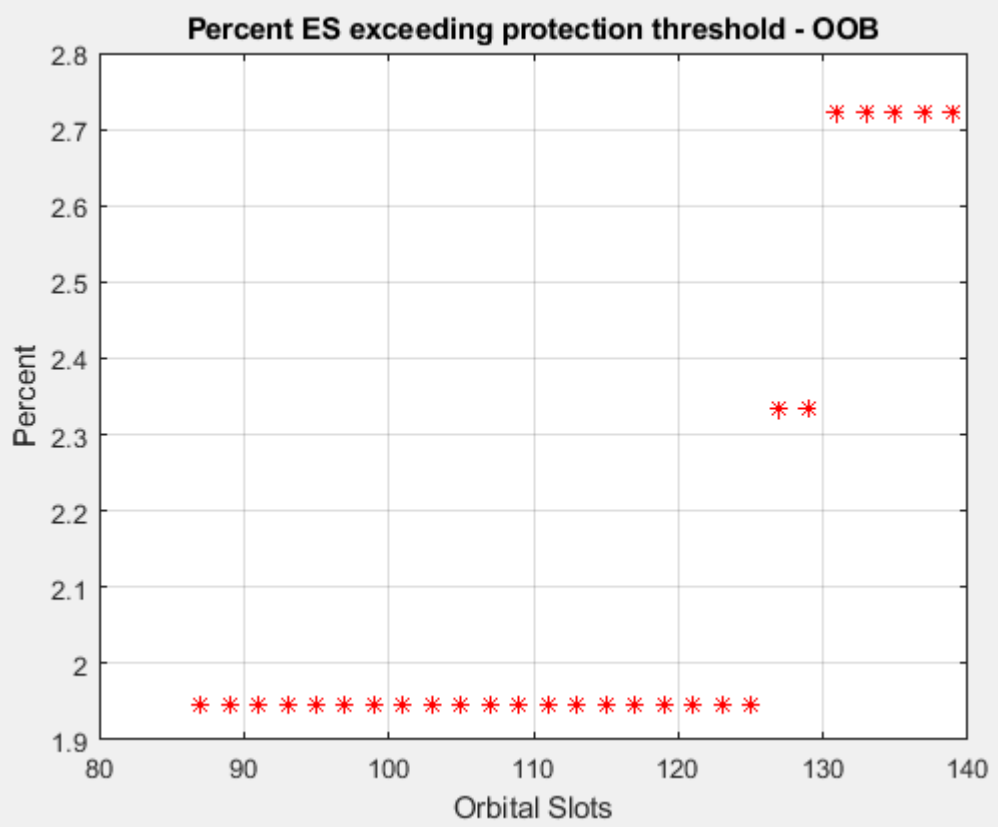


Figure B

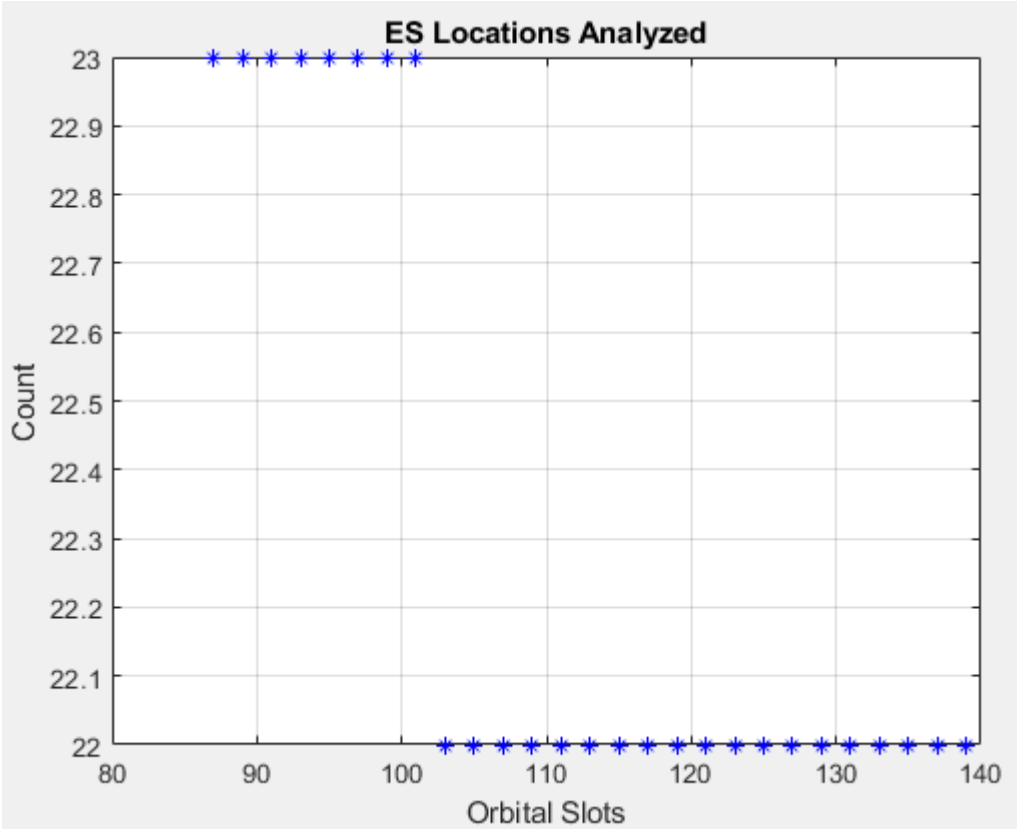


COMMSCOPE®

BS Impacting the ES - Inband

BS impacting the ES

- Characterizing the BS impacting the ES
  - Single Dominant BS, or
  - Aggregate effect of the BSs in the neighborhood
- Analyzing for the unique ES locations
  - Providing the data for a given ES location



Revised

BS Impacting the ES - Inband

Impacting Type: Dominant BS

Of the unique ES locations analyzed, where the interference from the BSs crosses the CBA-proposed threshold, the plot below provides the number (Figure A), and percentage(Figure B) of ES where the effect is due to dominant BS

Figure A

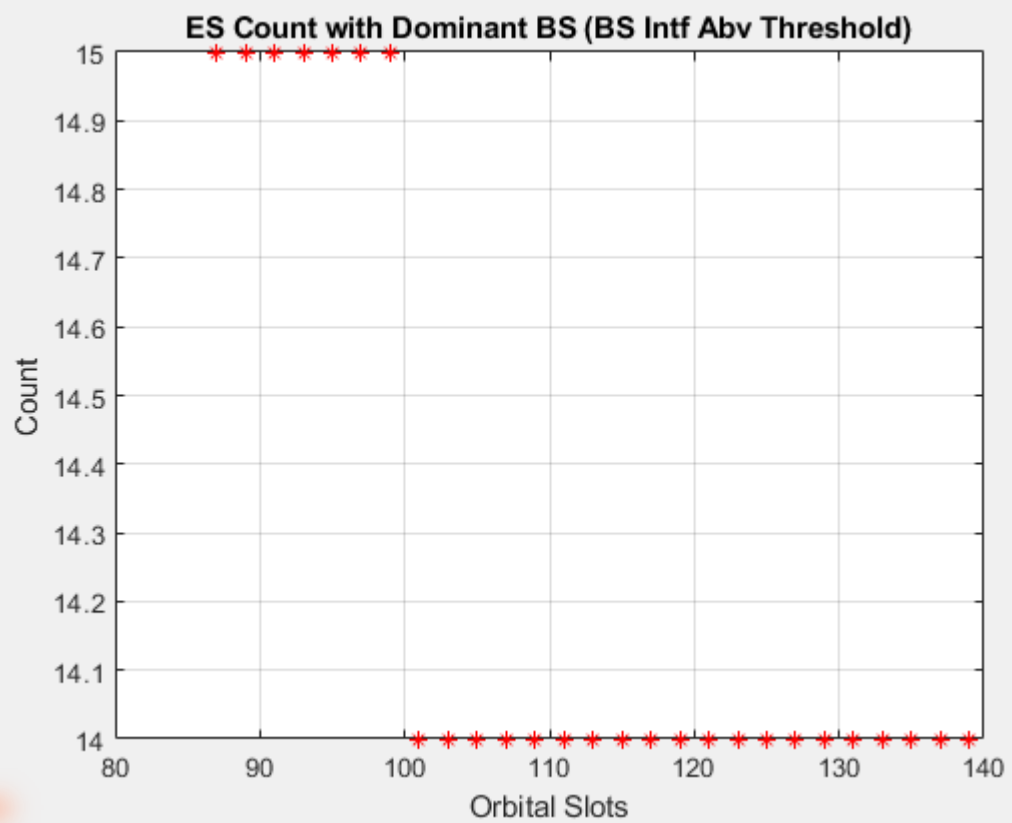
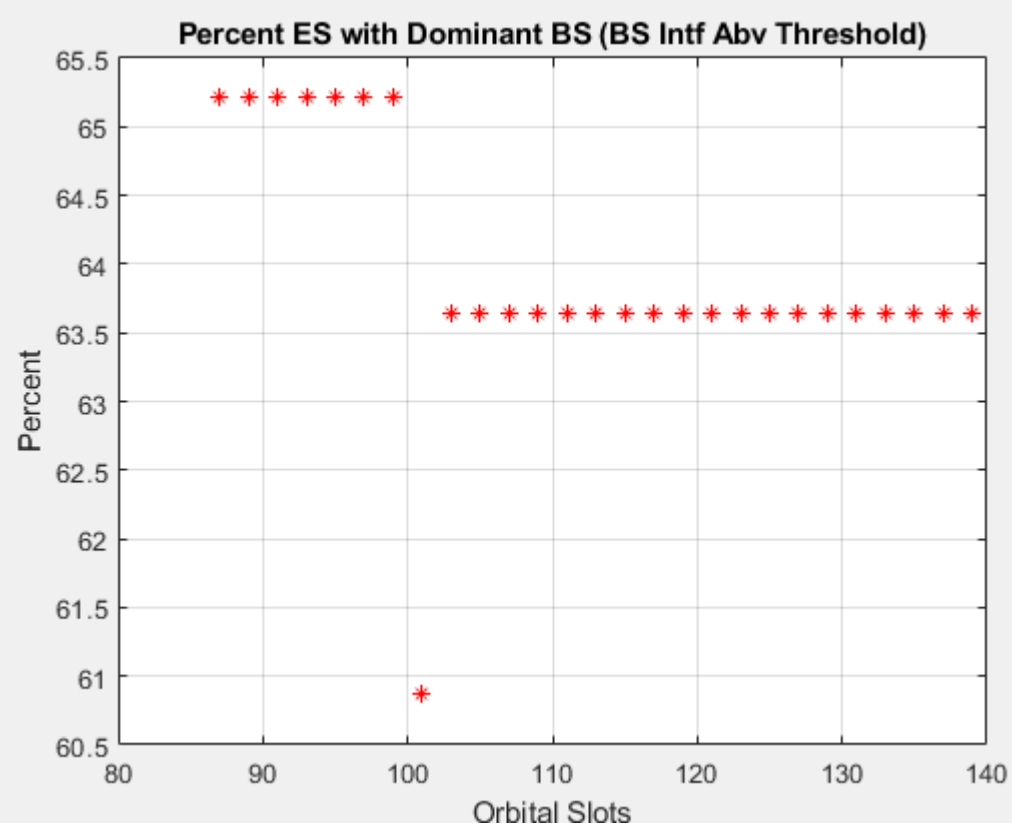


Figure B



Revised

BS Impacting the ES - Inband

Impacting Type: BS Interference below threshold but within 3 dB

Of the ES analyzed, where the interference from the BSs is below the CBA-proposed threshold but within 3dB of the threshold, the plot below provides the number(Figure A) and percent(Figure B) of ES, where the effect is due to dominant BS

Figure A

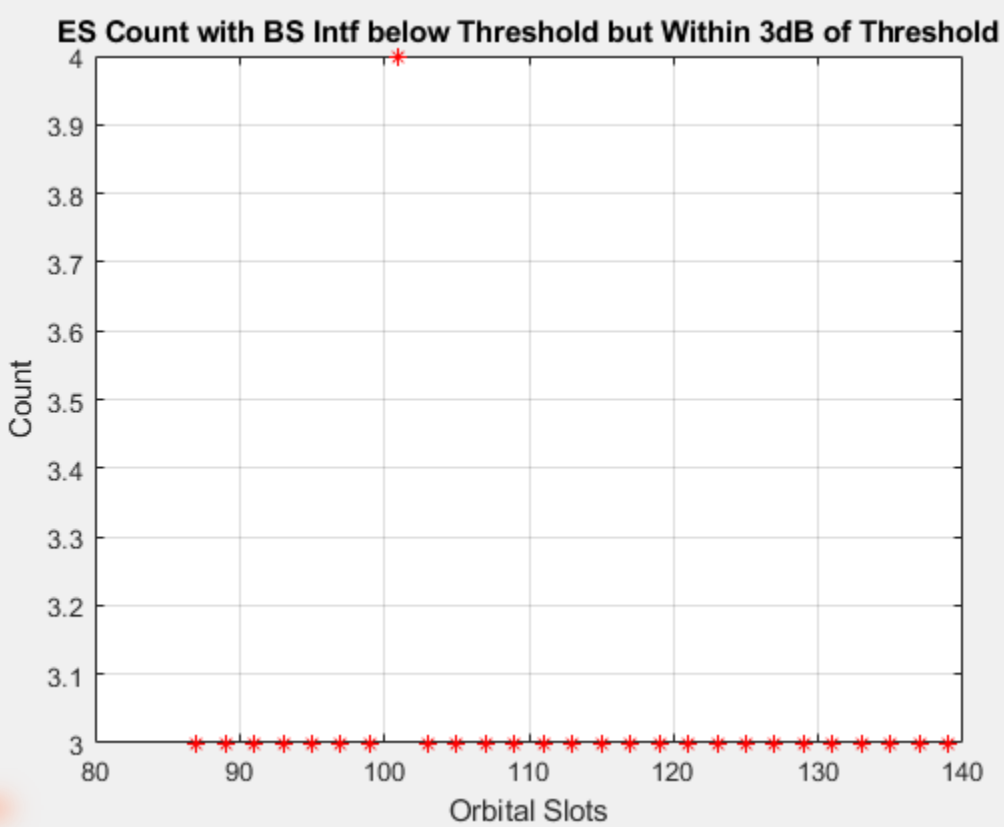
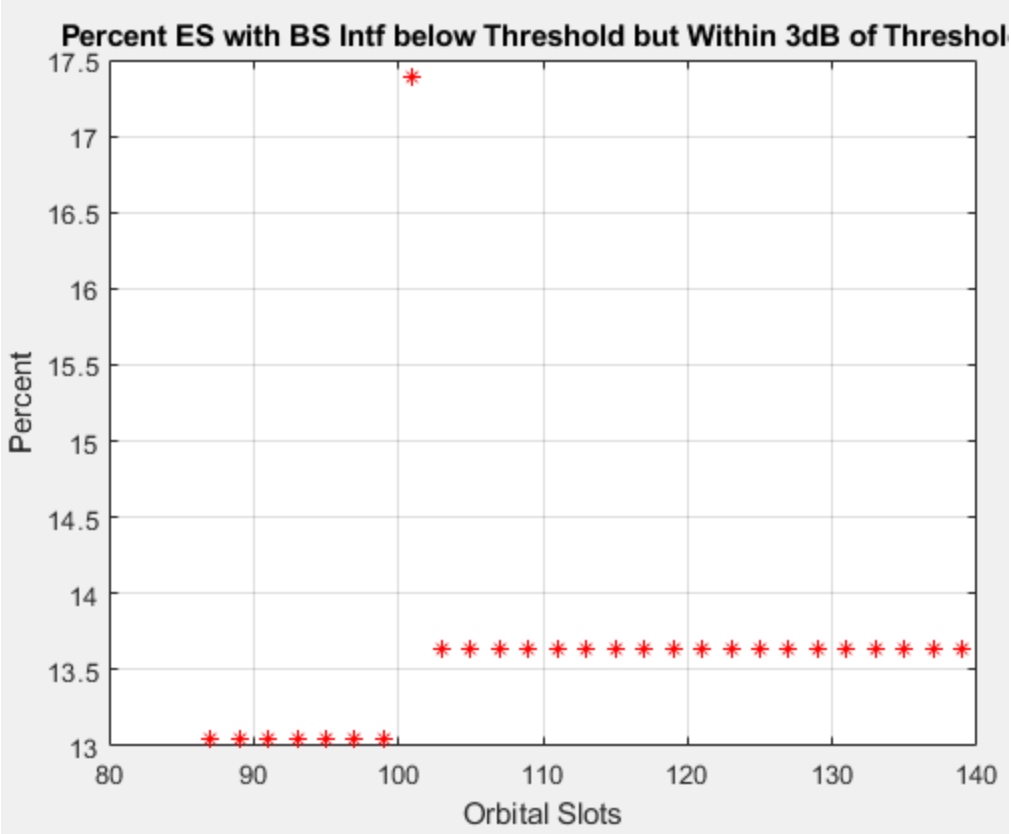


Figure B



Revised

BS Impacting the ES - Inband

Impacting Type: No Dominant BS

Of the ES analyzed, where there are no BSs above or within 3dB of the CBA-proposed threshold, the plot below provides the number(Fig. A) and percentage(Fig. B) of ES, where the effect is due to non-dominant BS

Figure A

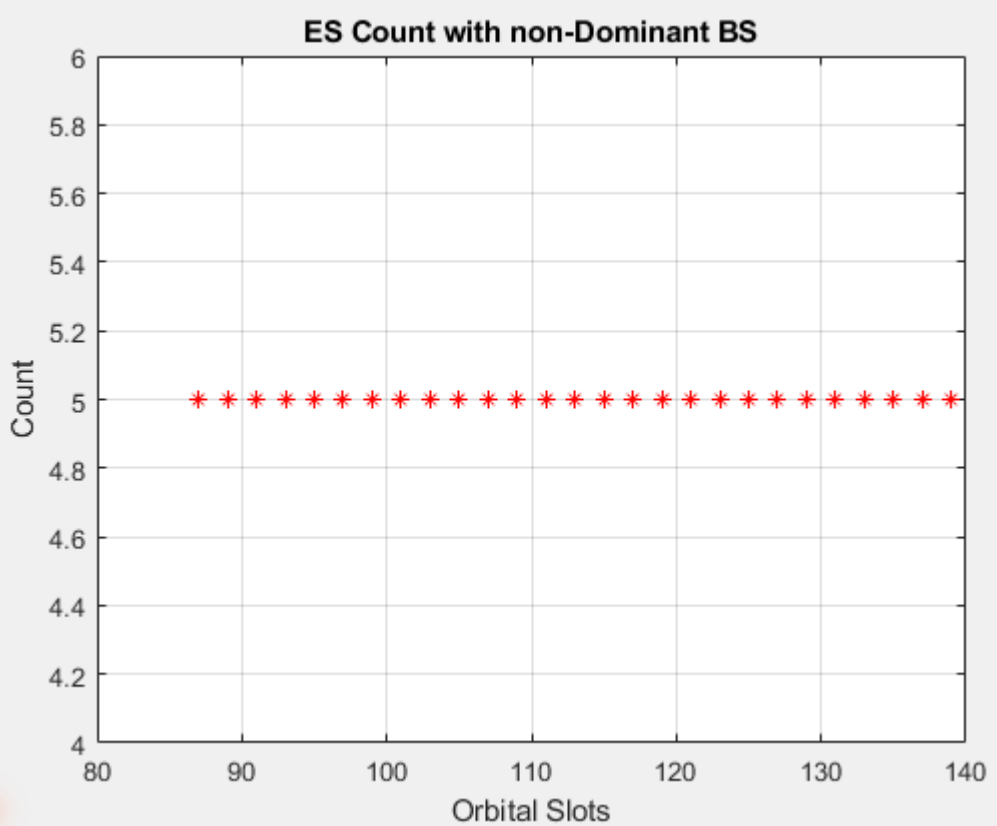
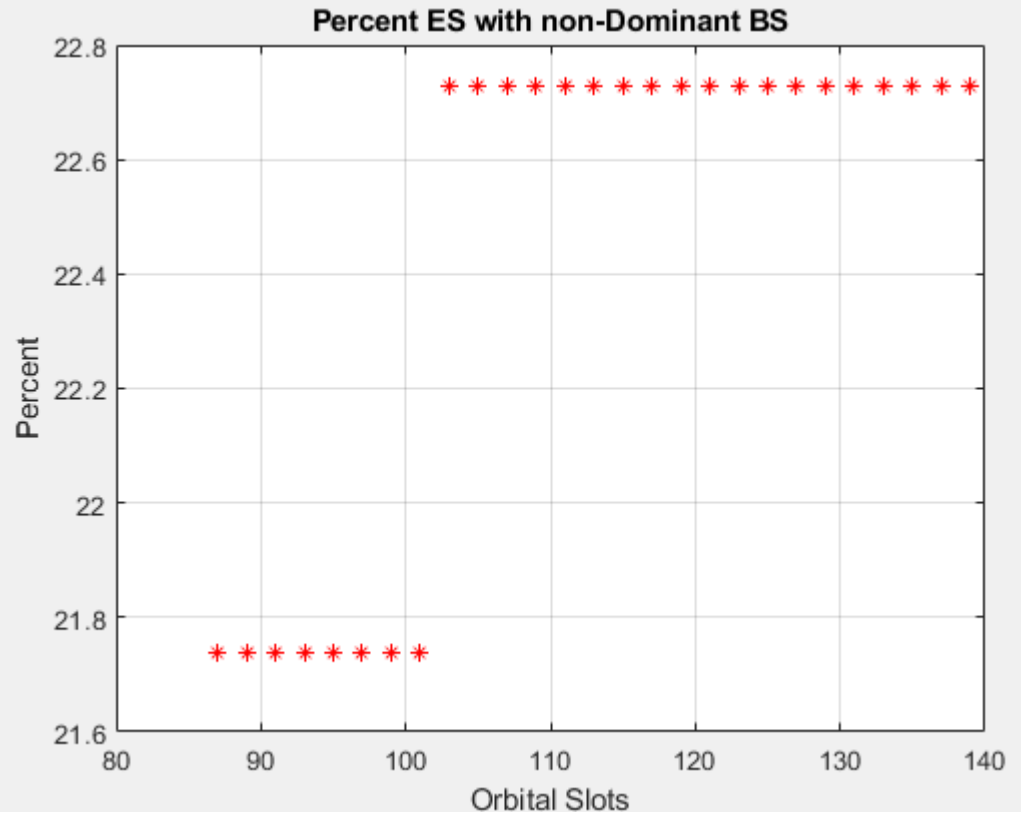


Figure B



Revised

COMMSCOPE®

BS Impacting the ES – OOB (-40 dBm/MHz)

BS Impacting the ES – OOB (-40 dBm/MHz)

Impacting Type: Dominant BS

Of the ES analyzed, where the interference from the BSs crosses the CBA-proposed threshold, the plot below provides the number(Fig. A) and percent(Fig. B) of ES, where the effect is due to dominant BS

Figure A

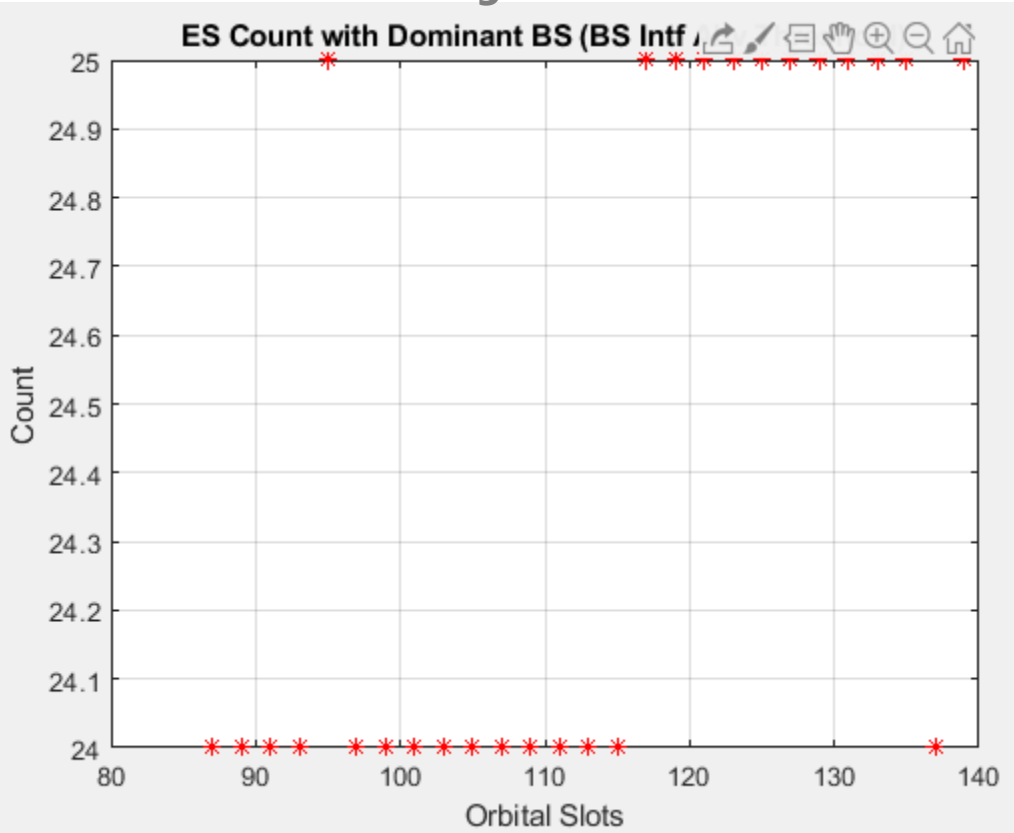
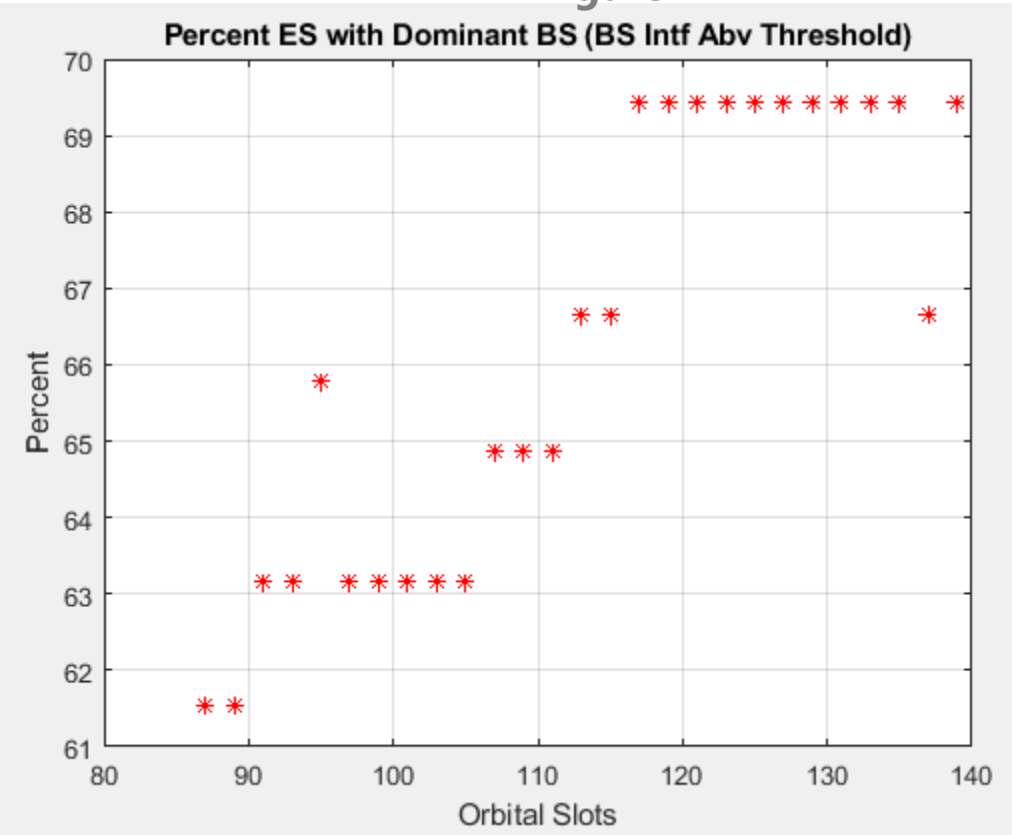


Figure B



BS Impacting the ES – OOB (-40 dBm/MHz)

Impacting Type: BS Interference below threshold but within 3 dB

Of the ES analyzed, where the interference from the BSs is below the CBA-proposed threshold but within 3dB of the threshold, the plot below provides the number(Fig. A) and percent(Fig. B) of ES, where the effect is due to dominant BS

Figure A

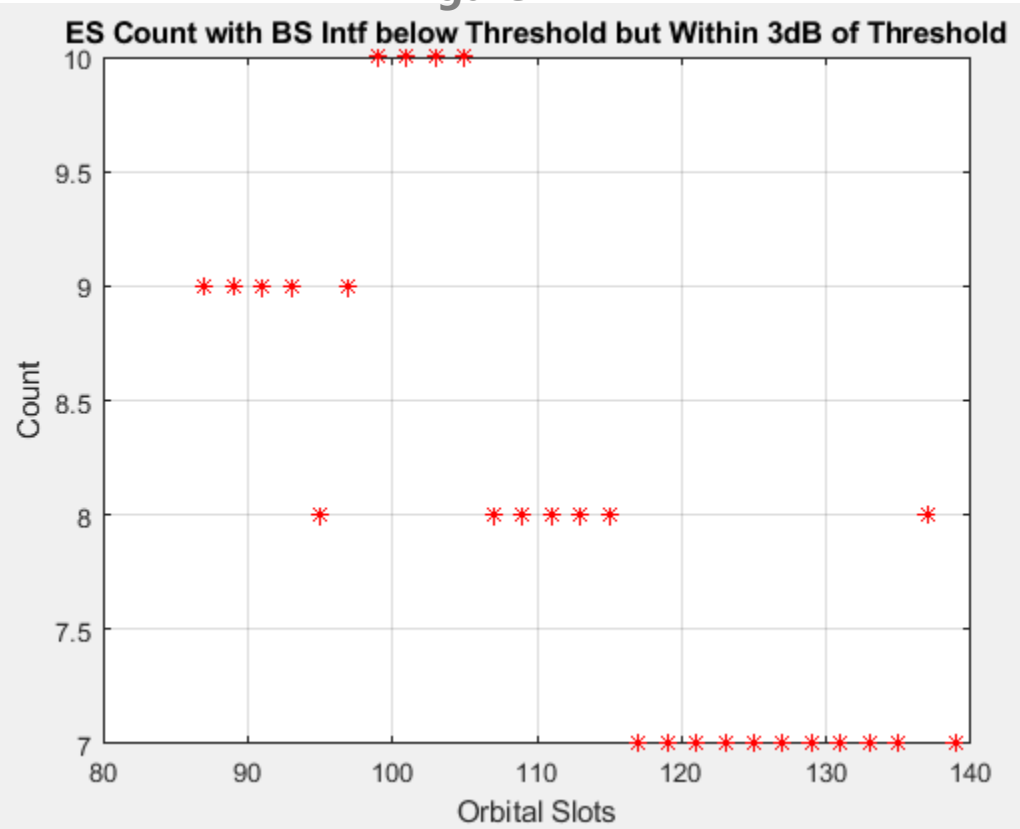
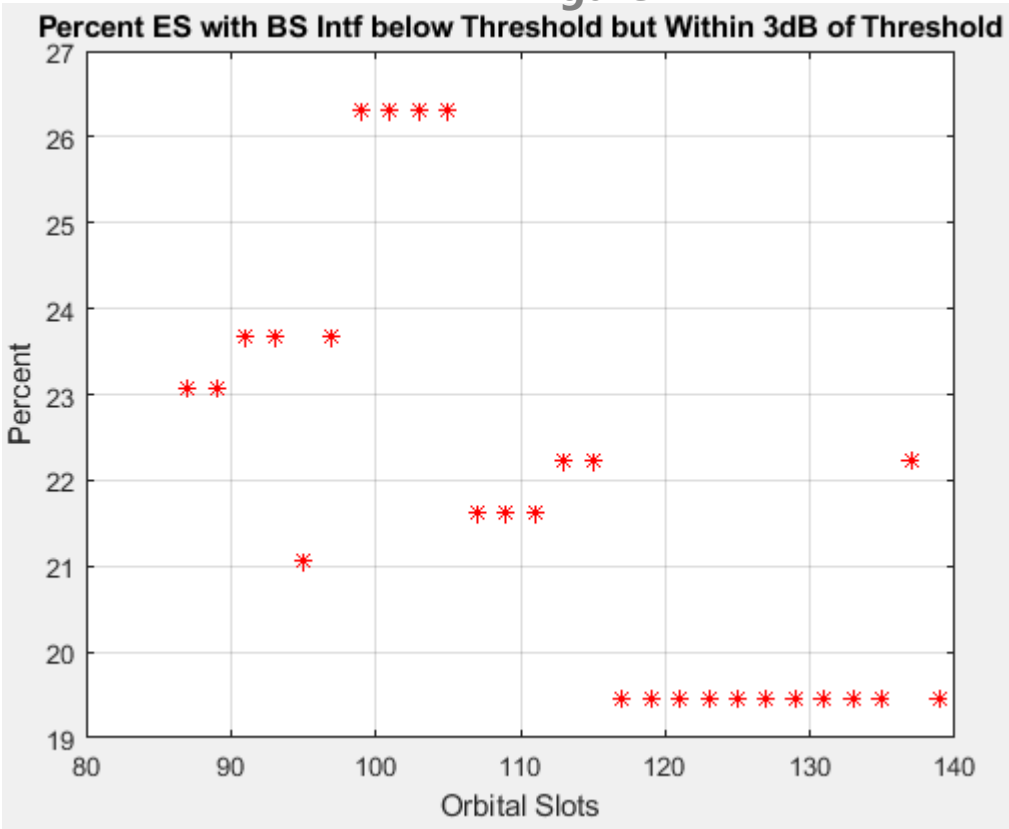


Figure B



BS Impacting the ES – OOB (-40 dBm/MHz)

Impacting Type: No Dominant BS

Of the ES analyzed, where there are no BSs above or within 3dB of the CBA-proposed threshold, the plot below provides the number(Fig. A) and percent(Fig. B) of ES, where the effect is due to non-dominant BS

Figure A

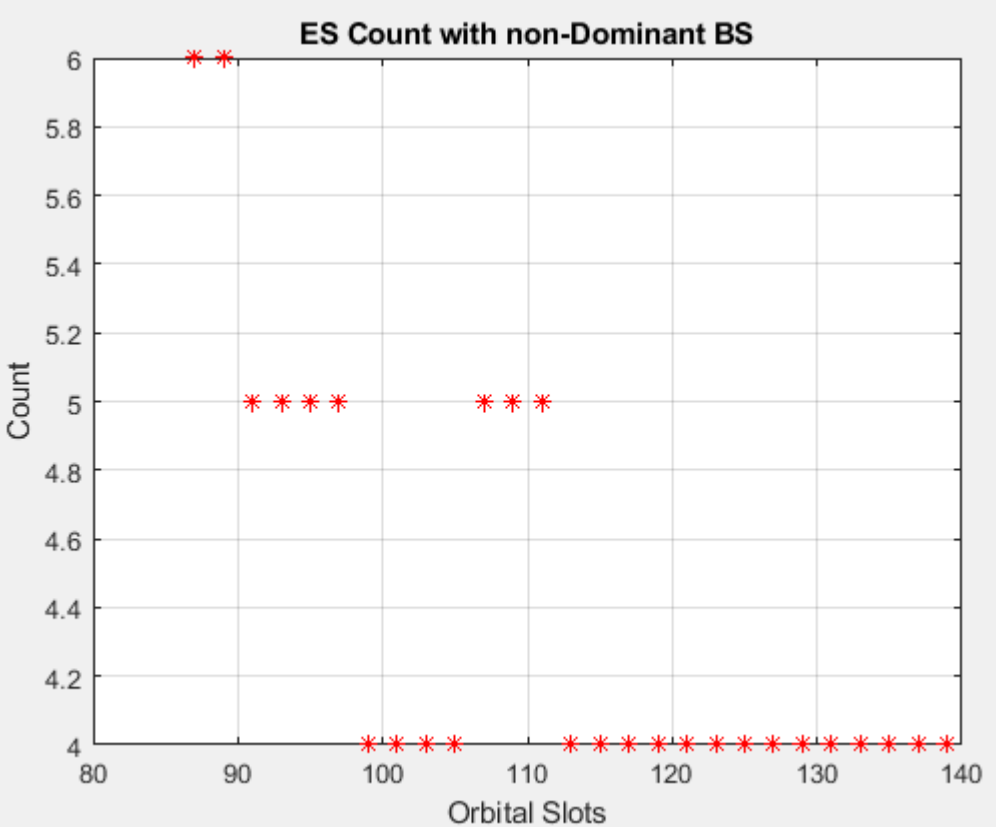
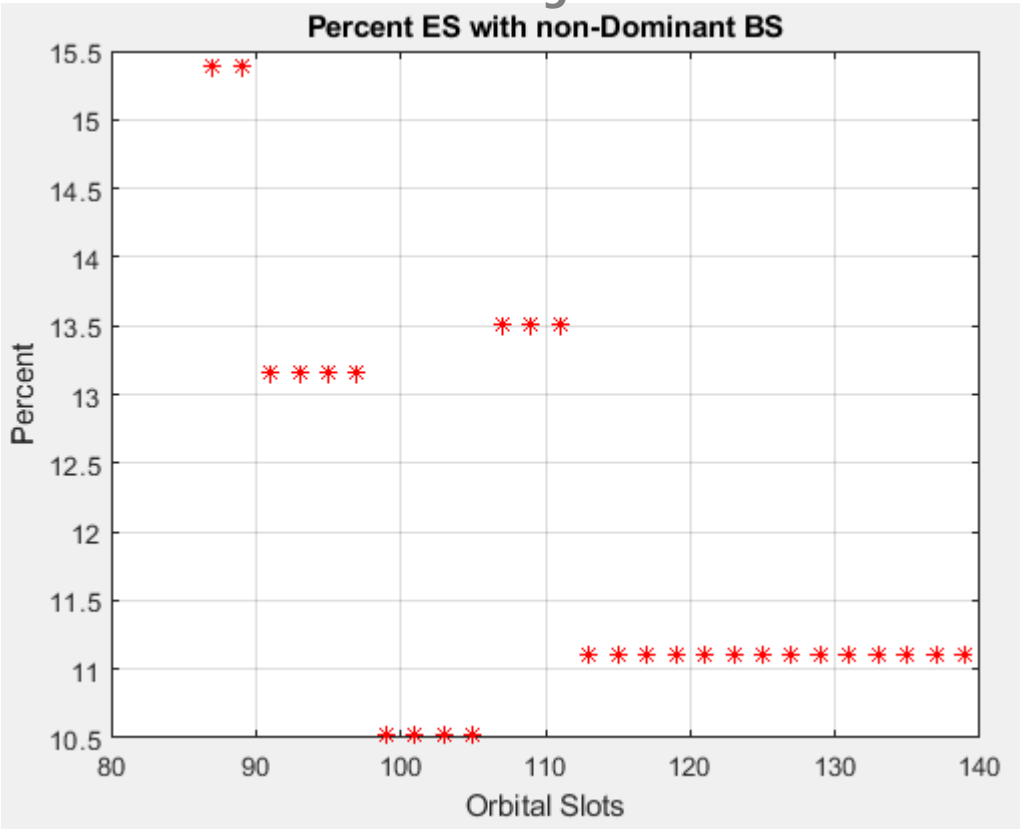


Figure B



Summary

- Using a narrow vertical beam and selective slots helps in reducing the number of ES that are impacted
  - Inband and OOB both cases improved (> 35 % improvement from the Horizontal only)
- In the OOB case, by moving the BS further from the band edge (3900 MHz) such that the OOB emissions into the 3900 – 4200 MHz is -50 dBm/MHz, there is more improvement
  - Less than 3% of the ES are impacted by the aggregate interference
- Also, we see that the impact on the ES are due to some dominant BS that are in proximity to the ES.
- OOB case

Revised

COMMSCOPE®

ariful.Hannan@commscope.com

navin.srinivasan.@commscope.com